AUGUST 1960

Heating Piping & Air Conditioning

. . . for Consulting Engineers • Mechanical (Heating, Piping, and Air Conditioning) Contractors • Engineers with Plants and Big Buildings

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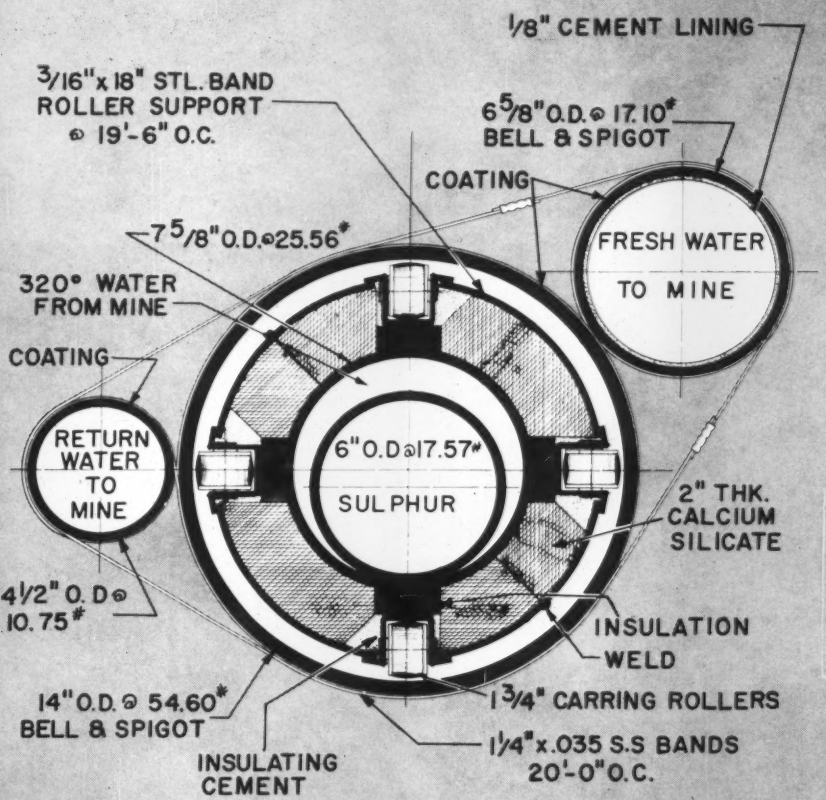

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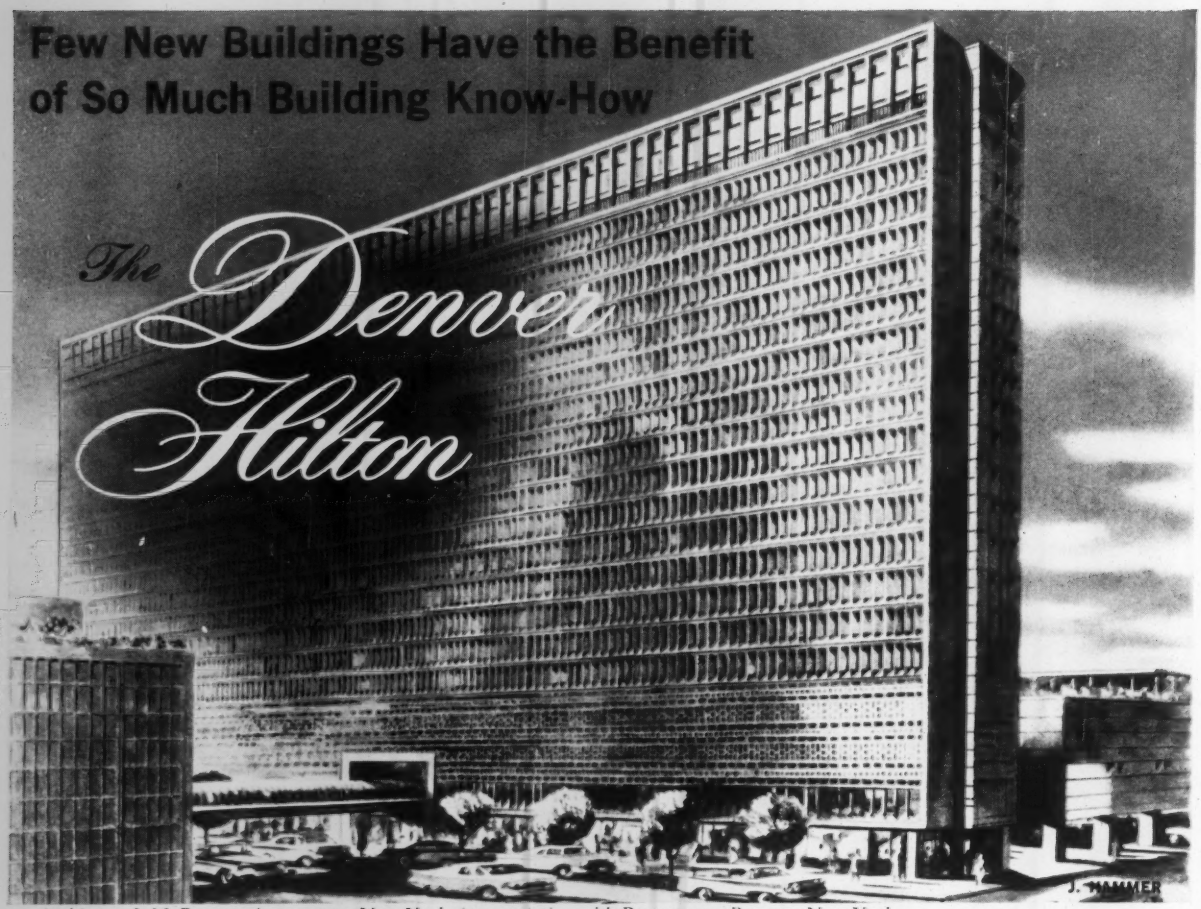

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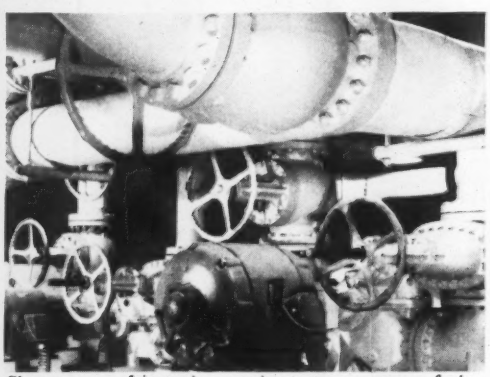

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VOL. 32, NO. 8 AUGUST 1960

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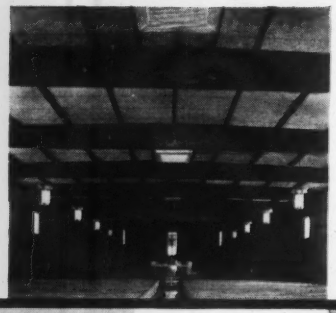

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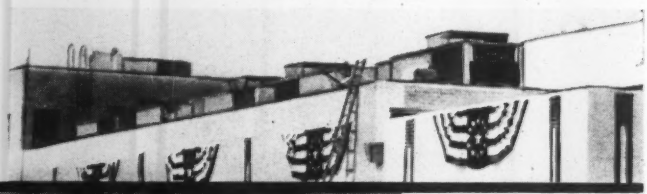

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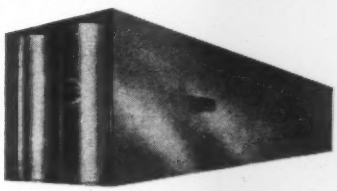

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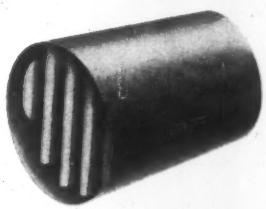

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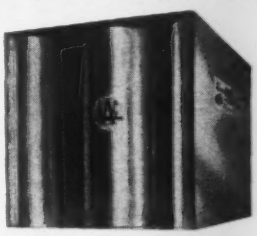

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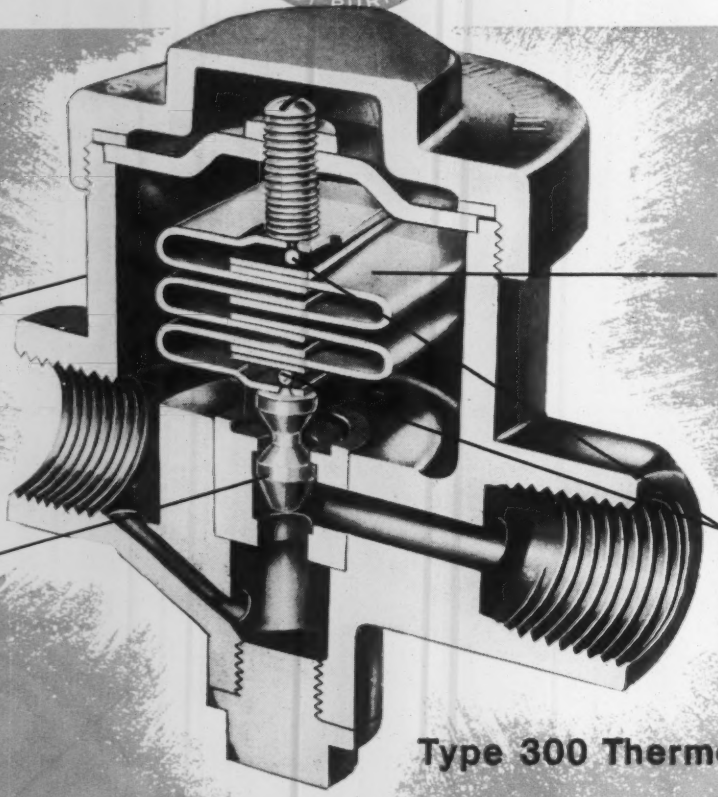

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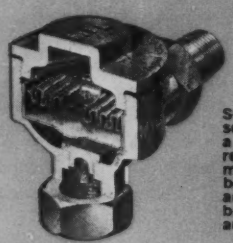

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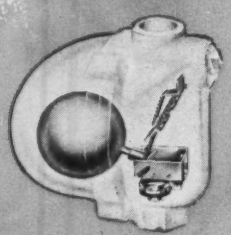

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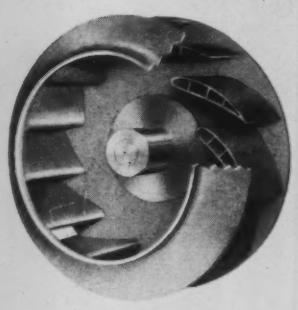

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LETTER FROM THE EDITOR

August 1960

Dear Reader:

Designing an underground piping system for moving 4500 tons of molten sulphur per day is especially tricky when it is realized that sulphur freezes at 240 F and the maximum temperature that can be tolerated is 320 F. The design considerations for a seven mile piping system of this type, traced with 320 F water, are discussed by C. M. Cockrell on pages 101 to 104. The expansion of the internal line carrying sulphur and the annulus carrying the heated water presented some interesting expansion problems. A system of antifriction rollers was developed to reduce the working stresses in these lines. The rollers also permit the inner lines to be pulled for repairs when necessary. The piping system was fabricated into 1000 ft lengths by welding the joints with an inert-gas, tungsten-arc root pass and a low-hydrogen, iron powder electrode for manual welding of the remainder of the welds. All welds were x-rayed, and the lines were hydraulically tested and visually inspected prior to launching.

As a result of some difficulties encountered in maintaining vital HTHW-produced steam pressures in an Air Force medical clinic, Joseph P. O'F. Lynam presents several design rules on page 105 that should be considered when planning these systems. He tells of the operating problems, relates how he tried to solve them, and explains the conclusions. One of these tells how impossible it is to control HTHW boiler output by the water level in the expansion tank. Another conclusion he makes is that the expansion tank cannot be sized on the basis of assuming a range of temperature variations for supply and return lines. Other rules are also given which are based upon this experience.

The article, "Consulting Engineers Report Their Specification Practices" on pages 107 to 109 will be of real interest to you. It is based upon a survey conducted recently among a representative cross-section of 300 consulting engineering firms. It was found that most consulting engineers write some form of open, alternate, or "or equal" specifications. Also, it was found that the majority felt that there are no changes taking place in preparing specifications that calls for major changes in their methods. In 96 percent of the firms, a principal of the firm who designs the system, or a project engineer, determines whose products will be specified. It is the engineers who design the systems that have this authority and responsibility.

Several methods were studied before deciding to proceed with the design of the air conditioning system for the U. S. Government Printing Office in Washington. Three adjacent buildings were involved, and it was decided to utilize as much of the existing equipment as possible to stay within the budget. Close coordination during the installation permitted all the printing operations to continue without interruption. William G. Robertson, Jr. and Ernest Moritz explain what was done in their article on pages 110 to 113.

Reducing labor cost and increasing weld quality are two main reasons for shop welding pipe automatically. This was the subject of Robert A. Wilson's talk before the Pipe Welding Panel at the recent Mechanical Contractor's convention. He centered his discussion around the fabrication of power piping, but he also said the method is applicable to low pressure piping fabrication too. This article starts on page 114.

LETTER FROM THE EDITOR (continued) --

Electric heating combined with warm air perimeter heating has proven to provide economical heating in Michigan Schools by Joseph B. Olivieri, consulting engineer. In his article on page 118 he explains how this system is designed and how it performs.

A simplified approach to mathematics for engineers is given on page 120, and your comments on this will be most welcome.

The relationships between velocity pressure and static pressure in the design of air handling systems is most important in the selection of the right fan. Gordon W. Neal has included a table of these relationships in his article on this subject on page 122.

The National District Heating Association marked the end of its 51st year at its recent annual meeting with an optimistic note. John F. Collins, Jr., Secretary-Treasurer of the Association, has prepared this annual report for publication in this issue on pages 125 through 127. He says both customers and steam sales are up, and both invested capital and facilities have increased in the last year.

The problems involved in air conditioning aircraft, missiles, and rockets are quite different from those encountered in the design of conventional systems. Robert Berner explains how these problems compare and gives some design rules in his article on pages 128 to 131.

A brine coil refrigeration system was selected for maintaining constant temperatures in the Sun Oil Co. test room for studying automotive fuels and lubricants. Paul London explains what was done and why in his article on page 135. Road tests can be simulated with a car travelling at 100 mph for the study of carburetor icing, cold weather starting, and other wintertime problems.

How to design gas piping fuel systems for direct fired heater installations is explained by M. H. Stern on page 138. He presents five design steps that should be followed and gives an example.

Noise generated and transmitted in air conditioning systems is not easy to control. Don Bahnfleth, HPAC Engineering Editor, has prepared another one of his valuable Engineering Data Files for this month, and in it he explains how to avoid these noise control failures, beginning on page 141. He points out that unsatisfactory noise levels can result even though current design procedures are followed explicitly. How can this happen? Because it is easy to overlook obscure paths by which noise can be transmitted to the conditioned space. Another reason is the workmanship is less than satisfactory, or sources of noise not quantitatively defined at present appear to upset the design. This phase of noise control, which is more art than science, is learned mainly through experience. Many case histories illustrating his points are included.

Many readers comment on articles published in these issues in the "Open for Discussion" pages, and this month these comments are on pages 91, 92, 93, and 96. The You'll Want to Know pages (41-46) contain the news and other items that permit you to keep abreast with what's happening in the field.

Bob Roose

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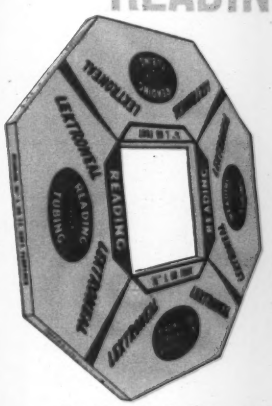

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2. SOFTITE's galvanized coating is applied so tightly that it actually becomes a part of the steel base . . . can't flake or peel no matter how you twist or torture it.
3. SOFTITE, made of famed Cop-R-Loy, lasts longer . . . gives more years of service for your customer's dollar.

Get the full facts on dependable, easy-to-work SOFTITE Galvanized Cop-R-Loy Steel Sheets from your Wheeling man this week. Or write Wheeling Corrugating Company, Wheeling, W. Va.

Steel

WHEELING CORRUGATING COMPANY • IT'S WHEELING STEEL!

WHERE TO FIND THE NEAREST WHEELING WAREHOUSE

BOSTON
2 Thompson Square
Charlestown District
Boston 29, Mass.
Charlestown 2-4770

BUFFALO
1722 Walden Ave.
Buffalo 25, N. Y.
Keystone 7444

CHICAGO
2547 Arthington St.
Chicago 12, Ill.
Seeley 3-5700

COLUMBUS
1100 Steelwood Road
Columbus 12, Ohio
Hudson 6-4318

DETROIT
6410 Miller Road
Dearborn 1, Mich.
Luzon 4-2005

KANSAS CITY
820 Atlantic Street
N. Kansas City 16, Mo.
Grand 1-4141

LOUISVILLE
1424-1436 S. 15th St.
Louisville 10, Ky.
Melrose 4-0541

MINNEAPOLIS
340-400 27th Ave., N.E.
Minneapolis 18, Minn.
Sterling 9-7233

NEW ORLEANS
1560 Tchoupitoulas St.
New Orleans 1, La.
Jackson 5-2291

NEW YORK
47-04 Van Dam Street
Long Island City 1, N. Y.
Stillwell 4-8580

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3rd and Bristol Streets
Nicetown Station
Philadelphia 40, Pa.
Davenport 9-1600

RICHMOND
1600 Jeff. Davis Hwy.
Richmond 24, Va.
Belmont 3-6936

ST. LOUIS
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St. Louis 10, Missouri
Jefferson 1-3900

ATLANTA
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Atlanta 3, Georgia
Jackson 4-0866

SALES OFFICES:

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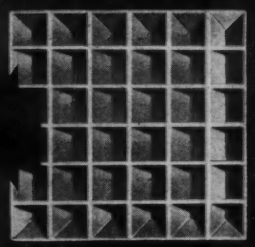
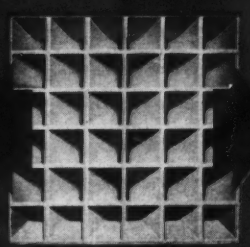
1100 E. Holcombe Blvd.
Houston 25, Texas
Jackson 8-2692

WHEELING
1134-40 Market St.
Wheeling, W. Va.
Cedar 3-2200

PIONEERS NEW



1



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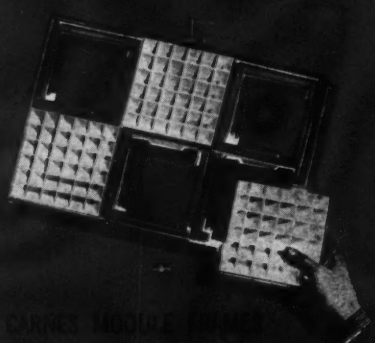


unobtrusive!
efficient!
versatile!

Combinations For Any Number of Patterns and Sizes

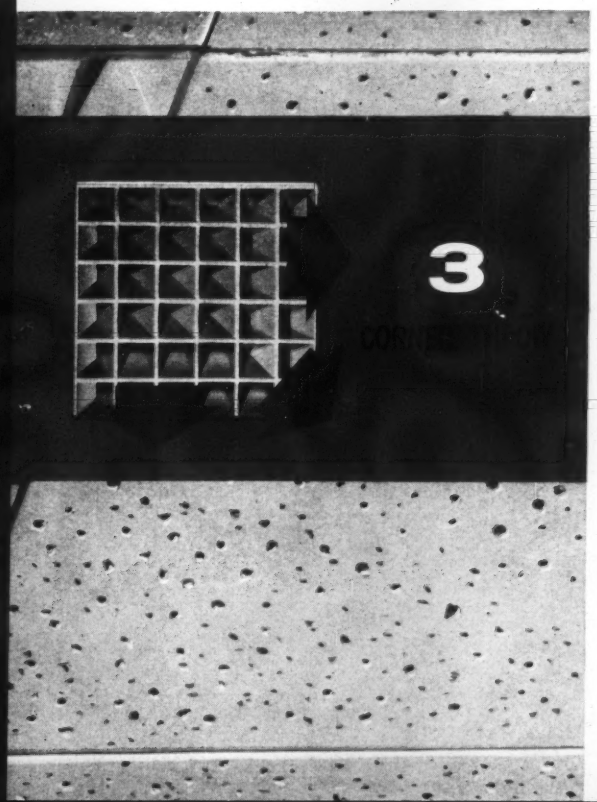
Rendering conventional round and square models obsolete, Carnes Modular Diffuser solves any air handling or design problem. This is accomplished by combining multiples of three basic 6″ square modules . . . 1-Way Throw, 2-Way Throw, Corner Throw.

When future expansion or alterations call for relocating partitions or fixtures, individual modules can be rotated or replaced. The directional flow of conditioned air is easily and inexpensively converted.

CARNES

CARNES CORPORATION
Verona, Wisconsin

CONCEPT IN AIR DISTRIBUTION!

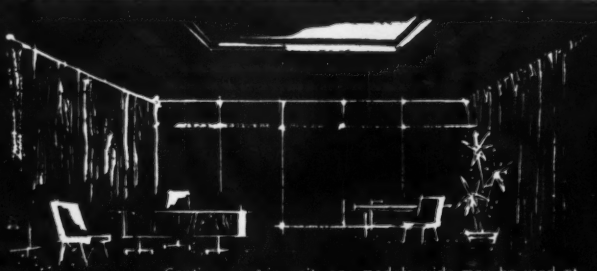


first to perfect

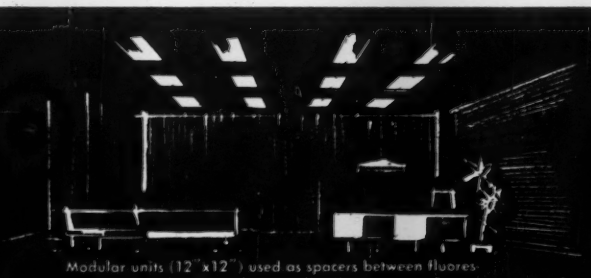
MODULAR PLASTIC DIFFUSER

that Blends Beauty with Utility

Architects and engineers — all executives and officials concerned with air conditioning — have long recognized the need for a diffuser which (a) is compatible with modern design, (b) is capable of adapting to future trends. In true tradition, Carnes has come up with the answer in its new high impact, flame-retardant plastic Model "M" Modular Diffuser with excellent color and dimensional stability. Attractive without being obtrusive, Carnes small-scale texture, white diffusers enhance the aesthetic quality of any type of ceiling. They have a minimum of "see through." They live in happy union with lighting fixtures of every design.

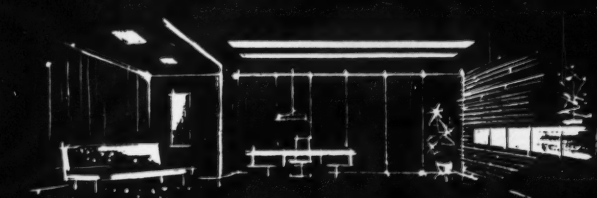


Continuous strip units one module wide may be used at windows and around ceiling coves to carry out architectural lines and blend with acoustical tile or plaster surfaces



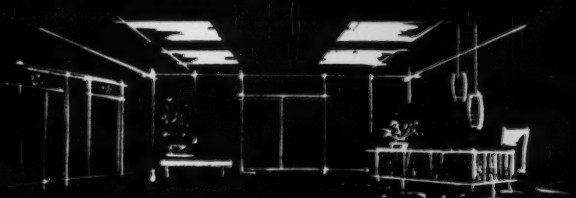
Modular units (12" x 12") used as spacers between fluorescent fixtures blend into the overall ceiling pattern. Return air may be handled through inconspicuous "A" Modular around columns or in walls

IN HARMONY WITH ALL CEILING MATERIALS AND LIGHTING FIXTURES



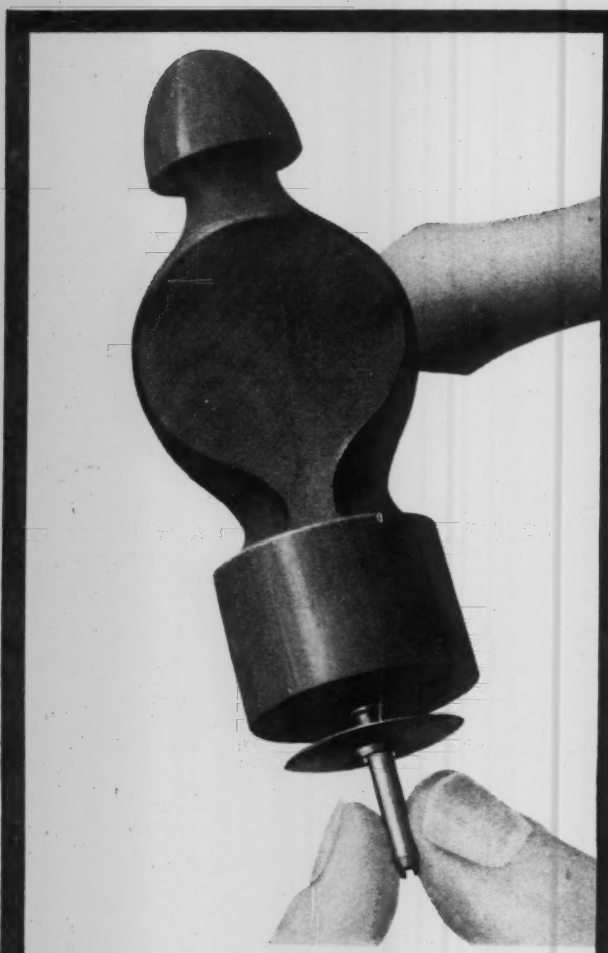
Alternating lines of lighting fixtures and diffusers can create a pleasing rhythmic pattern.

Continuous units may be butted to lighting units at windows to combine light and air distribution into a single design element.



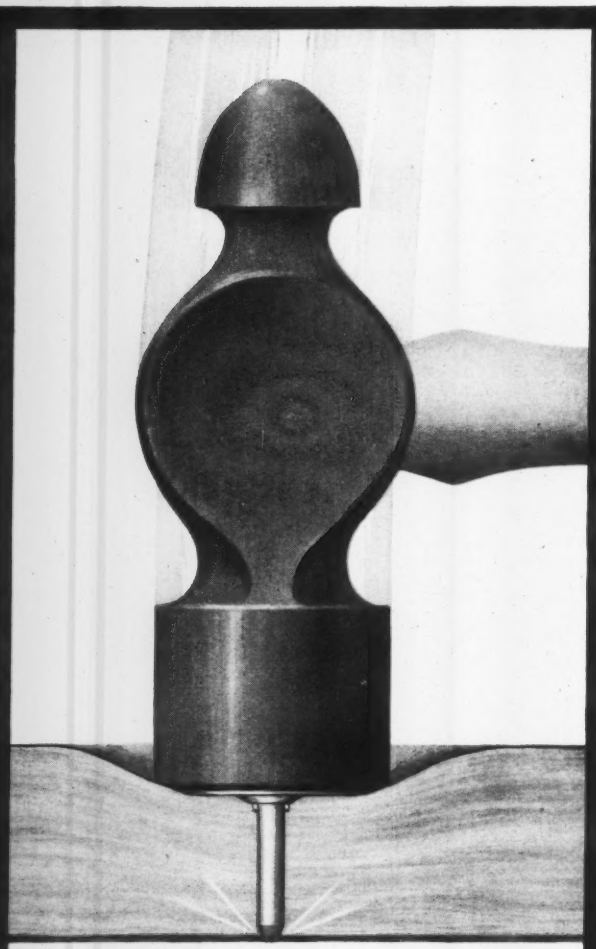
White plastic modules blend well with luminous ceilings and can be grouped into large or small units to fit any suspension system.

SEND TODAY! For complete details on the new Model "M" Modular Diffuser, write for Catalog No. 460.



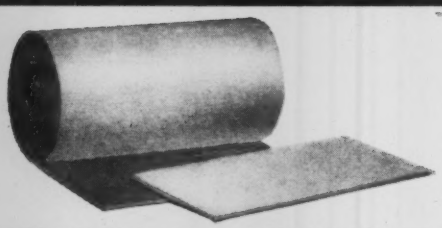
CLICK!

Special hammer with head chuck holds GRIPNAIL.



WHACK!

With one solid blow, the GRIPNAIL penetrates the duct liner insulation, bites into the metal, holds fast, but does not puncture the metal!

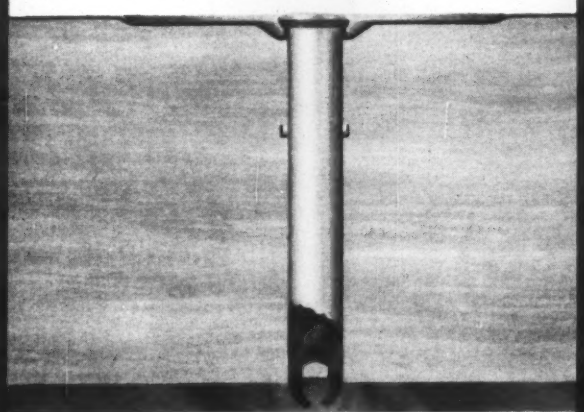


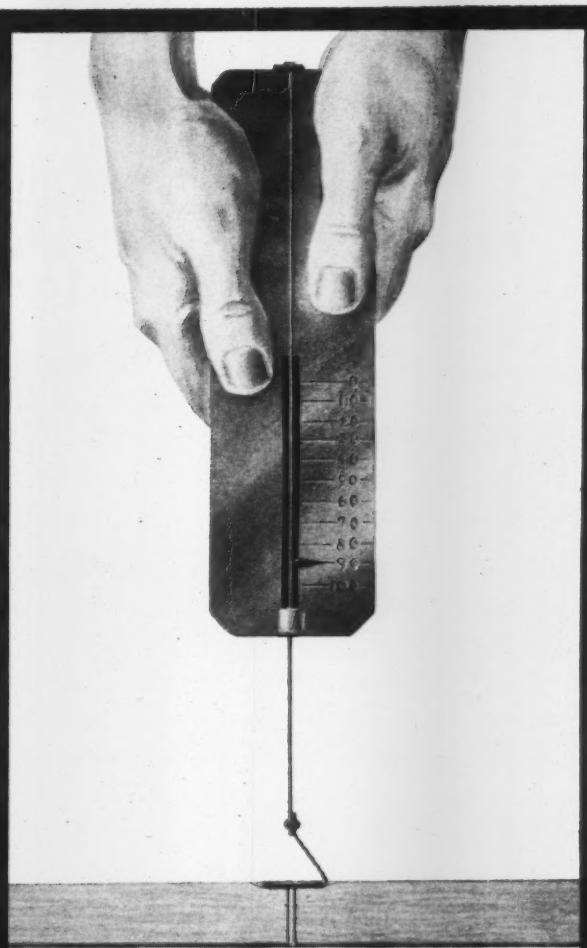
FIBERGLAS DUCT LINER . . . the flexible duct liner with a smooth glass mat surface that means low air friction loss, high sound absorption. Your Owens-Corning Fiberglas distributor stocks genuine Fiberglas Duct Liner in popular widths and thicknesses. It costs no more to get the extra advantage of Fiberglas over other duct liners.

The GRIPNAIL was specifically designed for use with Owens-Corning Fiberglas Duct Liner. It does away with glues, clips, adhesives and pin welding machines, when fastening insulation to ducts. There is no drying time, no large investment in welding equipment. All you need is the hammer and GRIPNAIL. And GRIPNAIL means faster working time.

The shank comes in ½-inch and 1-inch lengths. Exactly right for a firm bond without quilting.

NEW GRIPNAIL from Owens-Corning Fiberglas means fast, positive application of Fiberglas* Duct Liner to sheet metal. It does not puncture the duct, but literally grabs a small "hand hold" of metal and locks in place. Makes insulation fastening a three second job!





IT'S SET! SOLIDLY!

GRIPNAIL set solidly will withstand 50 to 90 lbs. pull —more than enough to hold the duct liner in place.

Permanent flanges on the shank of the nail automatically space the head for thickness of liner used. Washer and head are flush with the duct liner, with almost no impeding of air flow. The GRIPNAIL† is plated to resist corrosion.

Call your nearest Owens-Corning Fiberglas representative or authorized Fiberglas distributor for a demonstration of how GRIPNAIL works. You'll be amazed! *And*, Fiberglas Duct Liner is the perfect mate for GRIPNAIL.

Your local distributor carries stock for immediate delivery. Owens-Corning Fiberglas Corporation, Dept. 40-H, Toledo 1, Ohio.

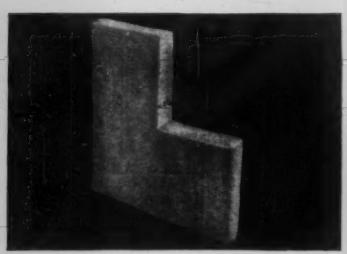
†Reg. applied for

OWENS-CORNING
FIBERGLAS

*T-M (Reg. U.S. Pat. Off.) O-C.F. Corp.

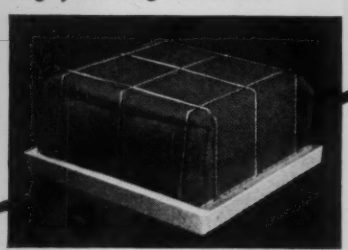
THE STARTLING FACTS ON THE

New ULOK BRAND Cube



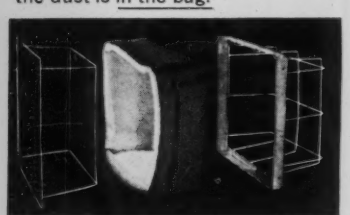
THE PERFECT FIBER!

UNION CARBIDE research has produced the truly ideal filter medium in DYNEL modacrylic fiber—a strong, high capacity fiber with an irregular, highly arresting cross section.



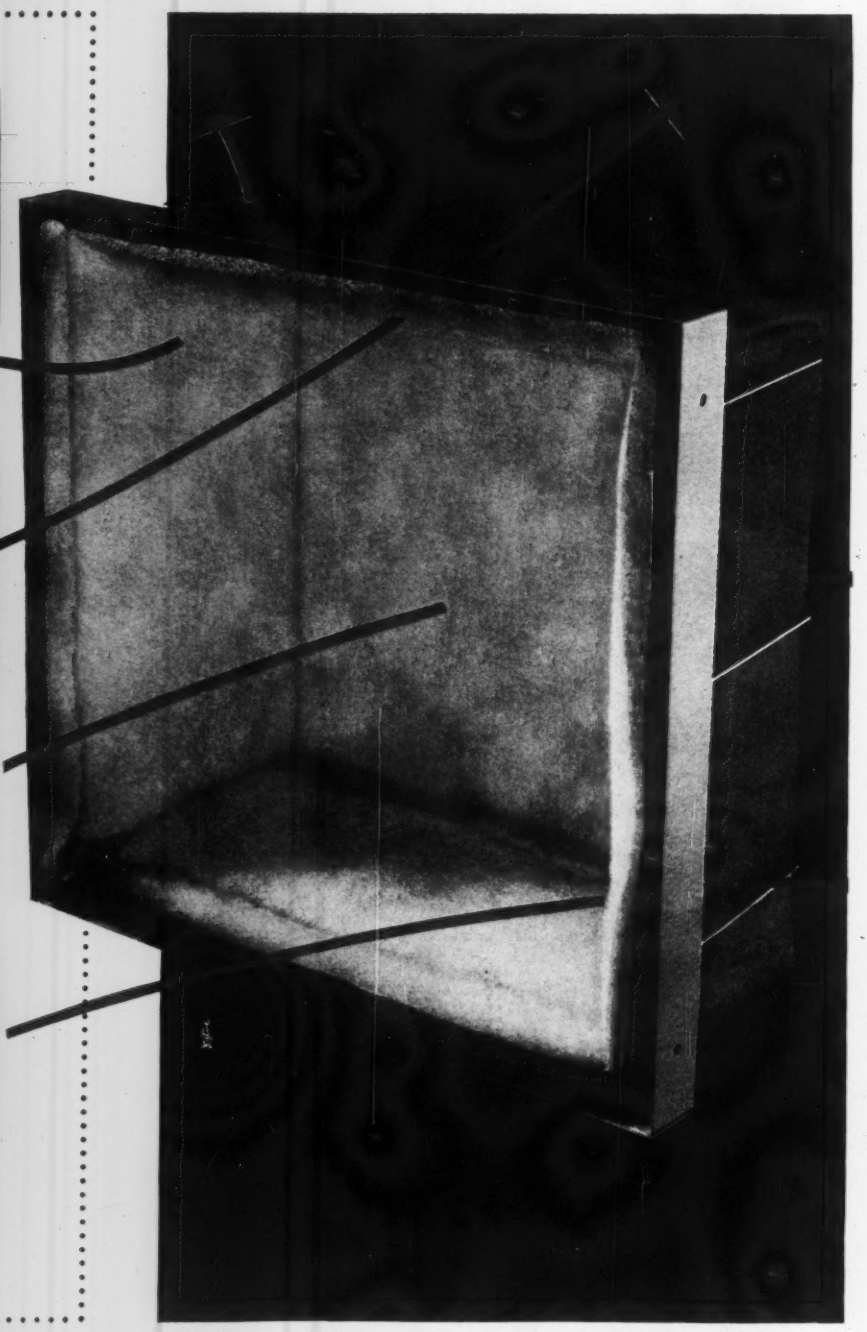
THE PERFECT FORM!

Basic component is a low density, three-dimensional batt, sewed into cube shape. Rust-proof retainer frame is inserted in batt, then batt is inserted in wire retaining basket. Final three-piece assembly is supported by holding frame within unit, is easy to handle—no sharp edges or "splinters". Easy to dispose of when full—simply collapse and discard . . . the dust is in the bag!



THE PERFECT FIT!

Shape of retainer frame inside batt permits filter to seal itself in holding frame. Final filter assembly is a tight, leak-proof, press fit.



Type Air Filter:

New Filter Medium!

DYNEL filter medium stops and holds unusually large quantities of dirt. Self-sealing, leak-proof assembly completely eliminates problem of filter bypass . . . provides maximum economy at highly acceptable filtration levels.

Saves Change-Over Dollars!

ULOK Cube Filter lasts 6 times longer. Dirt is first trapped on inside face of filter. As dirt builds up, air flow is shunted to large filtering area of four sides. Thus, even after several *pounds* of dirt have been collected, high filtering efficiency and low pressure drop is maintained. This "reverse loading" process increases service life *6 times* over that of conventional filters. Think of the savings in maintenance!

Uses Half The Space!

Medium-size ULOK Cube Filter has a filtering surface of 1040 sq. in.—140 more than a conventional 30″ x 30″ flat filter—yet it presents a frontal area of only 20″ x 20″. Filter bank area can thus be reduced by *half* with medium-depth filter, *even more* with deeper models.

At All Velocities!

ULOK Cube Type Air Filters afford the high filtering efficiency characteristic of low velocity units even in units employing air volumes as high as 1970 cfm!

Proved In Operation!

ULOK Cube Type Air Filters have been soundly proved in numerous installations. Reflecting a complete range of the filtering problems presented under varying operating conditions, these field trials were complemented by extensive and extremely severe laboratory tests.

Ideal for all commercial and industrial air conditioning, heating, and ventilating systems, ULOK Cube Type Air Filters are available in 12 sizes to meet any requirement.

WRITE TODAY FOR FURTHER INFORMATION AND PRICES.

UNION CARBIDE ULOK BRAND

UNION CARBIDE DEVELOPMENT COMPANY

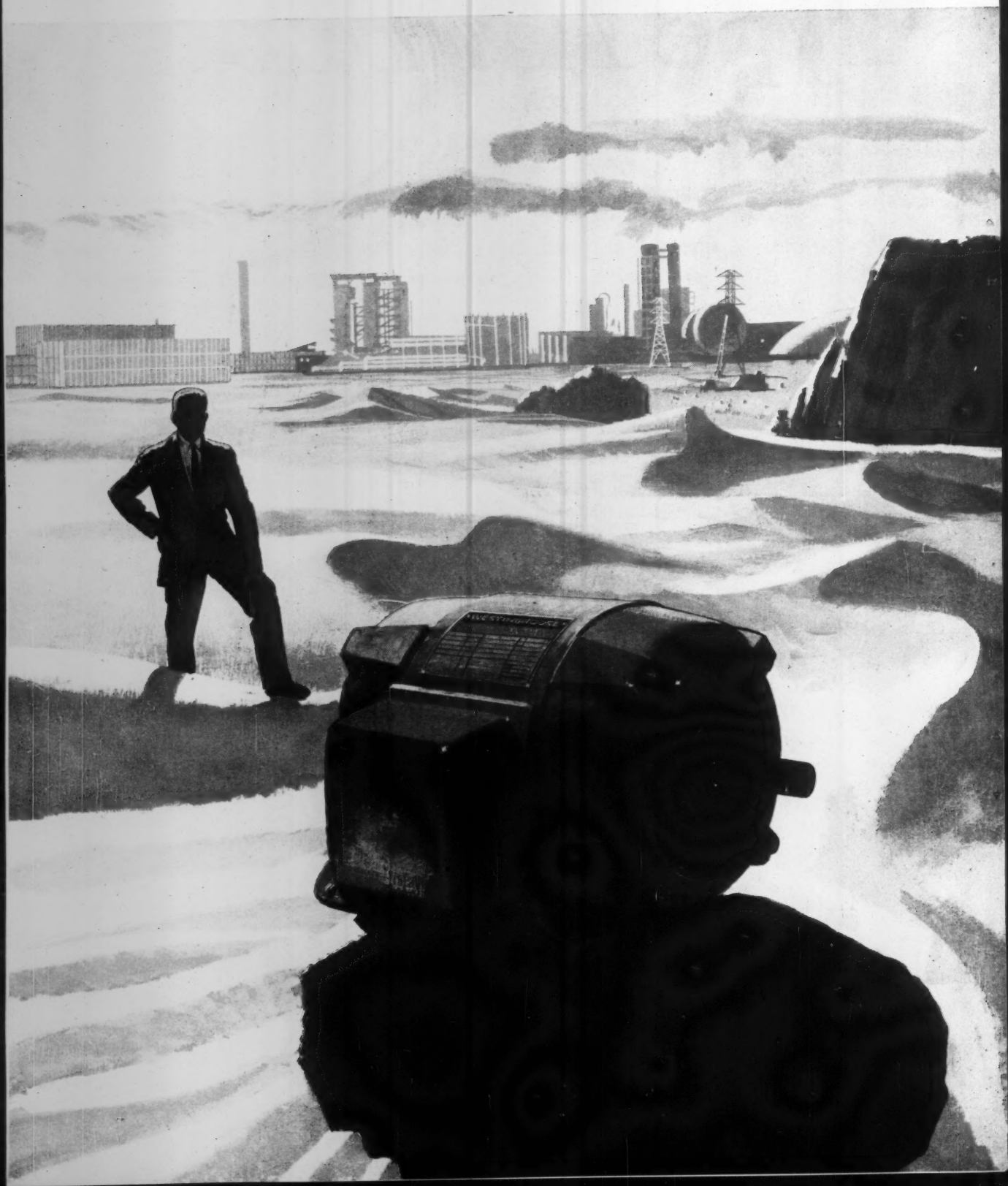
Division of Union Carbide Corporation

270 Park Avenue • New York 17, N.Y.

ULOK and UNION CARBIDE are registered trade marks of Union Carbide Corporation.

New *Guardistor*

THE MAN & THE MOTORS



FROM WESTINGHOUSE

Guardistor motors let you match the full capability of the motor to the job— with complete safety—absolute confidence

Our Marketing Manager says:

- "You can match the motor to the load . . . use all the motor you are paying for.
- Provides positive protection based on winding temperature . . . *not* load current and/or power supply fluctuations.
- Eliminates time and expense of changing winter-summer heaters. No nuisance tripping, it's fail-safe . . ."

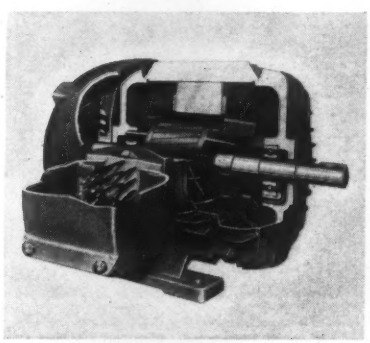
Our Engineering Manager says:

"With the breakthrough development of the Westinghouse Positive Temperature Coefficient thermistors, for the first time we can provide inherent protection against motor failure caused by excessive heat. The solid-state thermistors buried in the windings instantly sense excessive heat from any cause and simultaneously warn of trouble or automatically take the motor off the line. Thus, motor protection is placed where only true motor protection can be . . . in the windings."

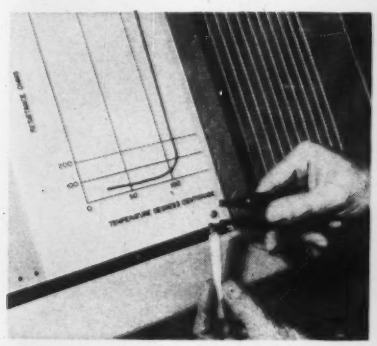
Call your Mr. Westinghouse for the application of a Guardistor* motor to your drive requirements . . . write for *Questions and Answers About . . . Guardistor* (B-7876). Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

*Trade-Mark

J-22160



Unlike remotely located sensing devices, PTC thermistors are buried in the windings of the Guardistor motor, instantly equating all temperature factors.

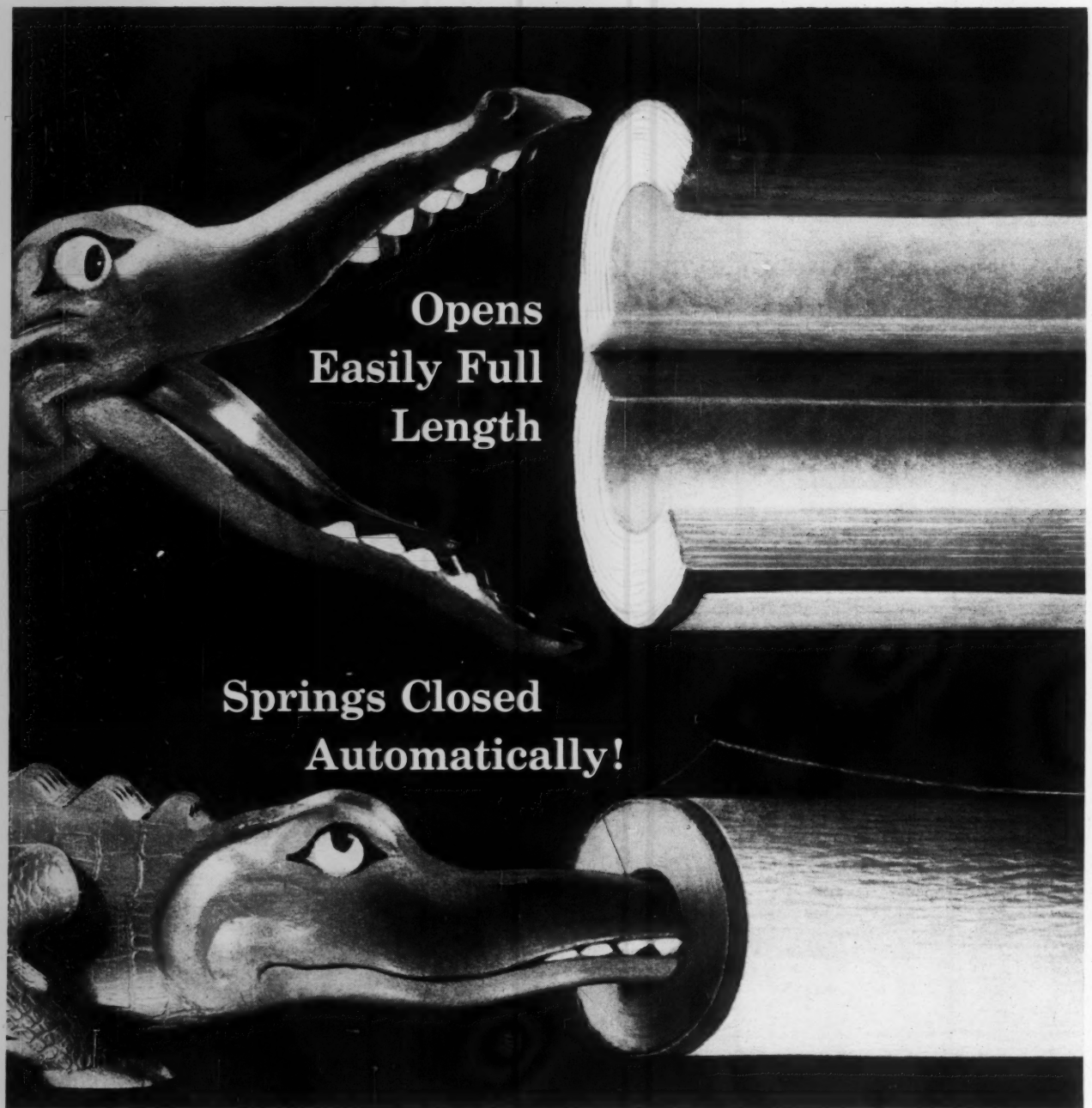


Ever alert PTC thermistors constantly totalize temperature, statically triggering an action *only* if critical temperature is reached.

MOTOR & GEARING DEPARTMENT

YOU CAN BE **SURE**... IF IT'S

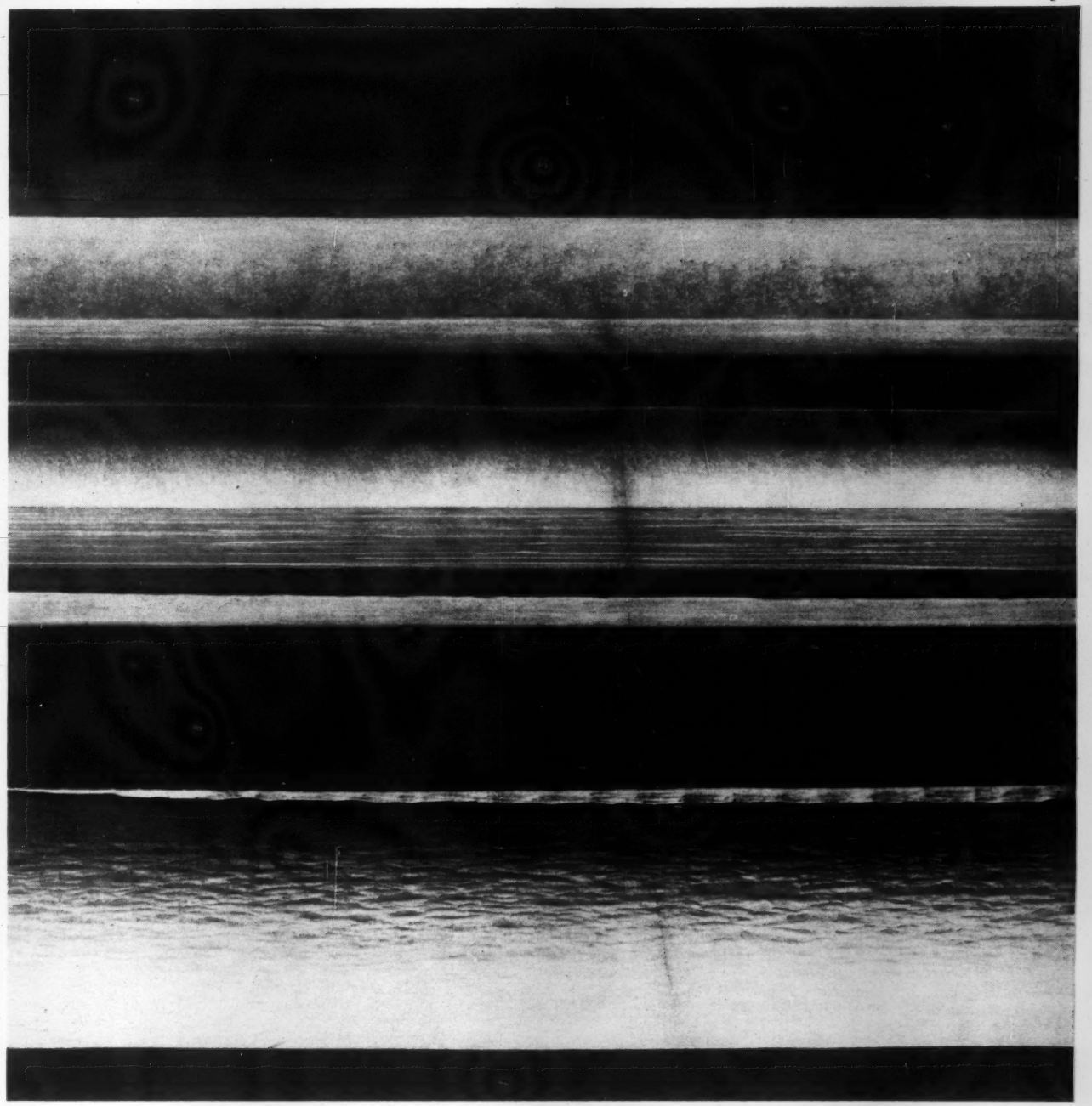
Westinghouse



Only J-M MICRO-LOK Fiber Glass Pipe Insulation Provides The Exclusive "Spring Hinge" Action!

Exceptional fiber resiliency and fiber alignment are the secret of Micro-Lok's easy-to-open, fast-to-close action. Only Johns-Manville Micro-Lok goes on so effortlessly, makes proper application so easy.

Micro-Lok has a remarkably low *k* factor which means lower fuel and power costs . . . gives hot or cold line protection from minus 120F to 370F above. The glass fibers in Micro-Lok do not absorb moisture . . . will not rot, shrink or swell.



Outside surface is smooth . . . has a neat appearance. It comes in a choice of factory-applied canvas, regular and flame-resistant vapor-barrier jackets. Available for all pipe and copper tubing sizes in standard thicknesses.

Contractors like the way Micro-Lok saves them job hours. It's featherlight, yet resilent enough to take rough handling. Drop it, bang it—no damage! Accurate inside diameter assures snug fit, and Micro-Lok is easily cut to fit joints, hangers or other irregularities.

Complete information from the nearby J-M Representative. Or write to Johns-Manville, Box 14, New York 16, N. Y. In Canada: Port Credit, Ont.

JOHNS-MANVILLE FIBER GLASS

"Buffalo"

You'll Find a 'Buffalo' Engineer

WHEREVER AIR OR LIQUID IS INVOLVED

In *your* business . . . in every type of industry, commerce . . . from astronautics to zinc mining . . . you'll find 'Buffalo' Fans and Pumps performing vital air and liquid moving jobs. ■ From the start, our basic aims have been to build quality products . . . and to provide helpful service in putting these products to work for you. Our industry-wide reputation for 83 years best tells how faithful we have been to these principles. ■ Yet with all these years of experience, 'Buffalo' is still a young company . . . young in ideas . . . young in the enthusiastic pioneering of new and better ways of handling air or liquids. ■ Your 'Buffalo' Representative is as close as your phone. Call him next time you want to put air or liquid to work.

Buffalo Forge Company, Buffalo Pumps Div., and the Squier Corp. . . . **Buffalo, New York** . . . Canadian Blower and Forge Co., Ltd., and Canada Pumps, Ltd. . . . **Kitchener, Ontario.**

BUFFALO FORGE COMPANY

Buffalo air handling equipment to move, heat, cool, dehumidify and clean air and other gases.

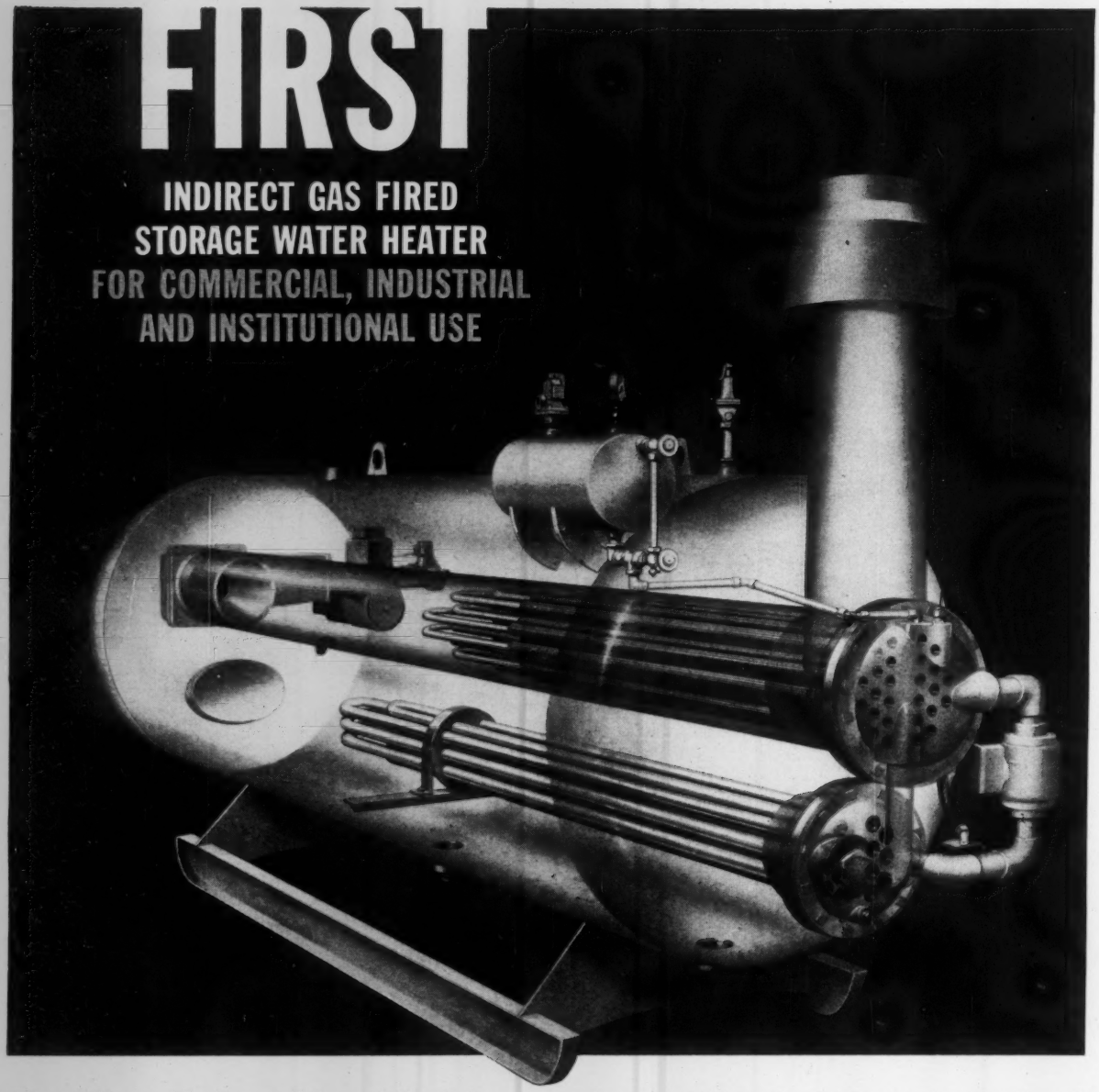
Buffalo Machine Tools to drill, punch, shear, bend, slit, notch and cope for production or plant maintenance.

Buffalo Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.

Squier machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.

FIRST

INDIRECT GAS FIRED STORAGE WATER HEATER FOR COMMERCIAL, INDUSTRIAL AND INSTITUTIONAL USE



No scaling • No drop-off in rated efficiency • No fuel waste • No on-the-job assembly • No complicated maintenance • No limitations on placement • Fully automatic • Copper heating surface

P-K SCALEFREE 230* is a unique rugged unit backed by P-K's 80 years of experience in building and designing quality water heating equipment. It heats water through hot intermediate distilled water. Transfer occurs below the temperature at which minerals that cause scaling precipitate. Efficiency remains unimpaired throughout service life. Linings of pre-Krete or copper are available to keep the unit free of rust and corrosion regardless of water conditions.

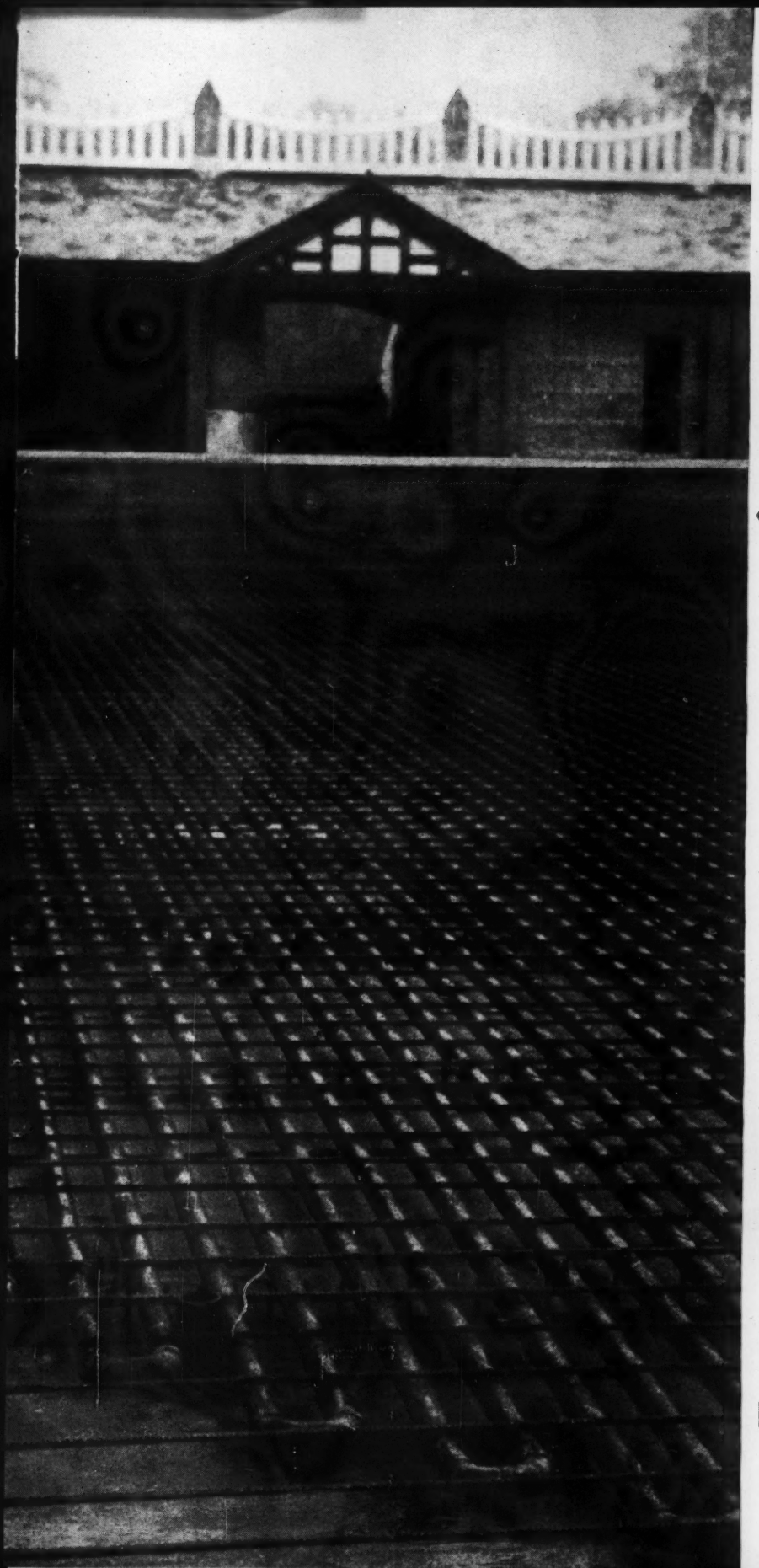
SCALEFREE 230 features a new P-K gas burner. It operates at maximum practical efficiency. Yet it gives almost noiseless service—does not rumble or boom on startup. This permits location almost anywhere in office buildings, institutions, schools, motels, etc.

SCALEFREE 230 is a complete fully automatic package that can be quickly set in place, hooked up and checked out. It is available in more than 100 storage and recovery combinations. Storage capacities range from 250 to 4000 gallons. Recovery sections range from 390,000 to 2,215,000 Btu. Write for catalog with full information.

*Patent pending

Patterson Kelley

102 Morgan Ave., East Stroudsburg, Pa.



4-D

48,000 FEET OF WROUGHT IRON PIPE PROTECT THIS $200,000 ICE RINK AGAINST CORROSION

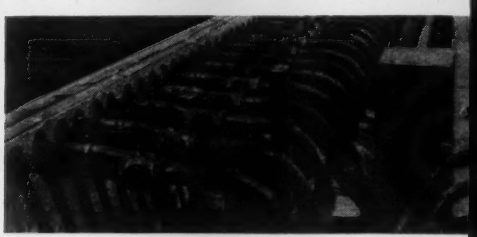
The White Plains, N.Y., Municipal Rink in Recreation Park is a year-round fun-spot. In the winter: uninterrupted ice skating. In summer: roller skating, square dancing, basketball, volleyball, tennis and free concerts.

Miles of 4-D Wrought Iron Pipe help this municipality clear its biggest maintenance hurdle: rink piping corrosion.

Brines will attack just about any piping material. That's why designers of this rink had to be extra-sure. So they specified 1¼-inch diameter 4-D Wrought Iron Pipe to carry the brine needed to help form a smooth hard surface of ice. Every time. Without any leaky interruptions.

4-D Wrought Iron's composition and structure—high purity base metal laced with thousands of glasslike iron silicate fibers—is unique indeed alongside ordinary piping materials. Its steadfast resistance to corrosion is a proven cost-cutter in skating and curling rinks everywhere.

Are you piping for permanence? Here's an important first step: write for our special report "Ice Skating Rinks—Their Construction and Maintenance." A. M. Byers Company, Clark Building, Pittsburgh 22, Pennsylvania.



Perfect bends in pipe at header area of circulating system reflect 4-D Wrought Iron's easy working properties. Peter Carver Associates of New York City was the design engineer. Armeco Ventures fabricated and installed the coils at the site.

BYERS 4-D WROUGHT IRON

TUBULAR & FLAT ROLLED PRODUCTS
Also Electric Furnace Amballoy Steels and PVC Pipe, Sheet & Rod Stock
Corrosion costs you more than Wrought Iron

NO NEED FOR CUSTOM JOB

Get the most from your pump investment

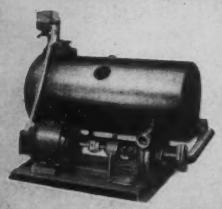
A standard type Skidmore Pump will meet the exacting requirements

There's a wide range of types and capacities for every heating pump need. Let Skidmore advise you on your next tough job.

TYPE UV

Type UV Condensation Pump is designed for below floor level returns, and is built in single and duplex units.

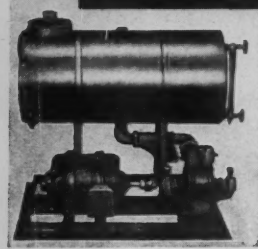
Write for *Bulletin No. 19-A*



TYPE HS

Type HS Pump is recognized for its dependable low operating cost. Capacities range from 1,000 to 65,000 sq. ft. EDR and pressures from 10 to 75 pounds.

Write for *Bulletin No. 14-A*



TYPE TM

Type TM High Pressure Turbine Pump. Designed for pressures up to 150 pounds and boilers to 250 H.P.

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SKIDMORE TYPE "CCVS"
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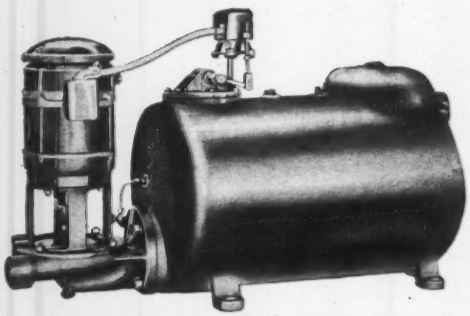

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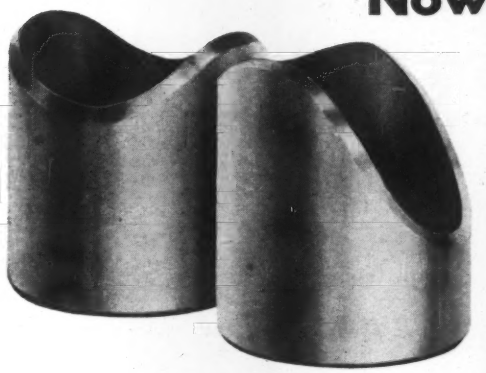
Now available in 45° and 90°

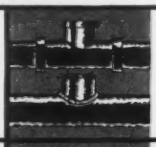


ALLIED
SADDLE FITTINGS

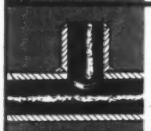
. . . high-strength, pre-shaped fittings install at a fraction of the cost of forgings

Pre-engineered for precision welded branch connections, Allied Saddle Fittings, coupled with existing holecutting equipment and modern welding techniques, offer a quick solution to the problem of combating the rising cost of pipe fabrication and piping maintenance. Check the following advantages . . . then specify ALLIED SADDLE FITTINGS for your next job:

LEAKPROOF . . . ALLIED fittings become an integral part of the pipe line. Welding causes a permanent fusing of metal that makes leaking virtually impossible.

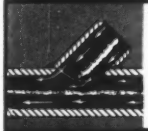


LIGHT WEIGHT . . . Weight reduction is an attractive feature of ALLIED fittings . . . both from the standpoint of economy and handling ease.

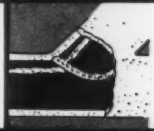


STRENGTH . . . Fittings and weld have the same wall thickness as the run pipe. Weak spots, often encountered in threaded joints, are eliminated.

EASY INSTALLATION . . . Improved holecutting and welding techniques make ALLIED the simplest of all fittings to install. No cumbersome forgings to maneuver. Ideal for close quarter work.

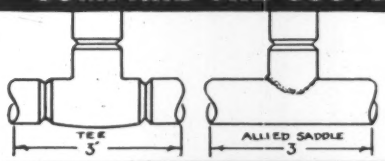


EVEN FLOW . . . The elimination of recesses in the wall (as in threaded couplings) reduces the chances of erosion caused by turbulence . . . especially where laterals are used to direct flow.



QUICKLY INSULATED . . . Uniform outside diameter of pipe line makes insulating easy. The eliminating of bulges gives you a smooth, professional job.

COMPARE THE COSTS ON THIS 3-ft. STRAIGHT TEE FABRICATION



Following are factual figures, based on actual case histories, wholesale pipe cost and labor rates. As an example — a 4" forged tee costs $14.79 plus pipe cost and labor or a total of $23.06. Compare this with a 4" ALLIED pre-shaped nipple at a cost of only $3.14, plus 3 feet of run pipe and labor for a total of only $10.97. That's a big difference of $12.09, or approximately 50% savings on a 4" tee. Multiply this by the number of tees you buy each year and you will see that, besides realizing a whopping big saving, Fabricators are in a more competitive position because lower bids on pipe fabricating contracts can be submitted.

FORGED FITTINGS					ALLIED SHAPED NIPPLES					
Pipe Size	List Forged Tee	WHSE. Pipe Cost	Labor	Total	Pipe Size	List Allied Fitting	WHSE. Pipe Cost	Labor	Total	Tee Save
4	14.79	3.27	5.00	23.06	4	3.14	4.27	3.56	10.97	12.09
12	131.49	9.44	17.80	158.73	12	11.09	21.28	11.73	44.10	114.63

SHOP LABOR RATES USED IN ABOVE COSTS $6.00 PER MAN HR.

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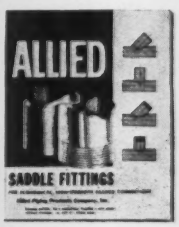
WRITE FOR THE NAME OF YOUR ALLIED DEALER AND CATALOG GIVING COMPLETE COST, SIZE, DESIGN AND TESTING DATA.

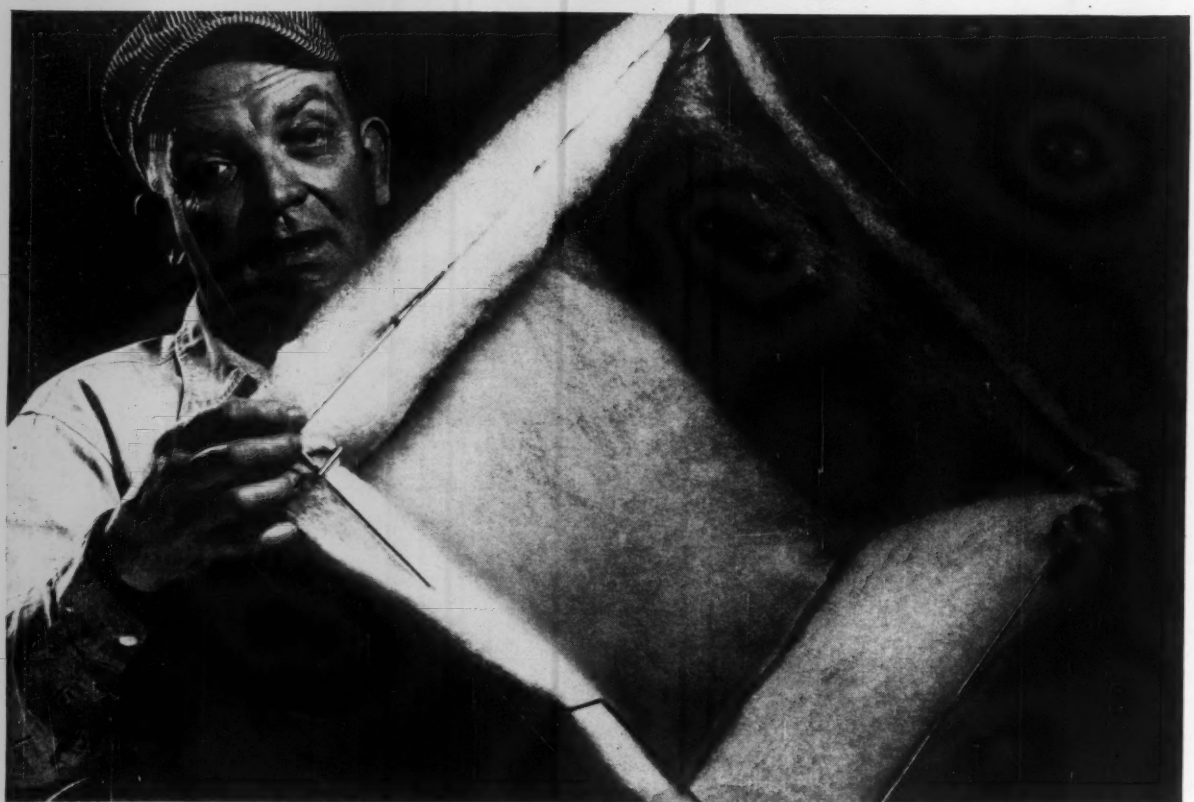


Allied Piping Products Company, Inc.

Fittings Division: **1585 S. Lincoln Ave.,** **Salem, Ohio**

Another new development using

B.F.Goodrich Chemical *raw materials*



ULOK Brand Cube-Type Filters, developed by Union Carbide Development Company, a Division of Union Carbide Corporation, New York, N. Y., offer the face area of a 30" x 30" air filter in the frontal area of a standard size filter, 20" x 20". Non-woven material is Dynel modacrylic fiber bound with Geon vinyl latex by Fiber Bond Corporation, Chicago, Illinois. B. F. Goodrich Chemical Company supplies the Geon vinyl latex.

New, cube-shaped air filters use non-woven made with Geon

The unusual shape of this new replacement air filter is planned to take advantage of a fibrous filter medium of uniform density—a non-woven construction made with Geon vinyl latex as a binder. The cube shape presents more filtering surface to the air stream, providing far higher efficiency over far longer life.

The filter design demonstrates how the unusual balanced physical properties of Geon latex as a binder can pay off. Geon is responsible for the resilience and strength in the batt, allowing the material to be cut, sewed, and formed into the required shape while still maintaining its 2" loft.

Here's another example of the way that versatile Geon vinyl can help to improve a product or open new markets. For more information about Geon and the many different ways you can use it, write Dept. GG-4, B.F.Goodrich Chemical Company, 3135 Euclid Avenue, Cleveland 15, O.

Geon VINYLS

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

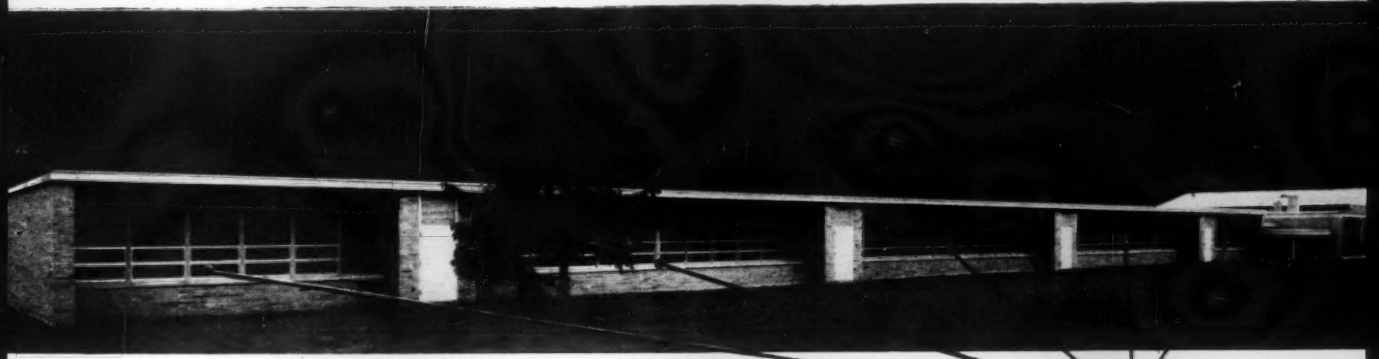
B.F.Goodrich GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

PROJECT: School

PLANNING: Highly Flexible

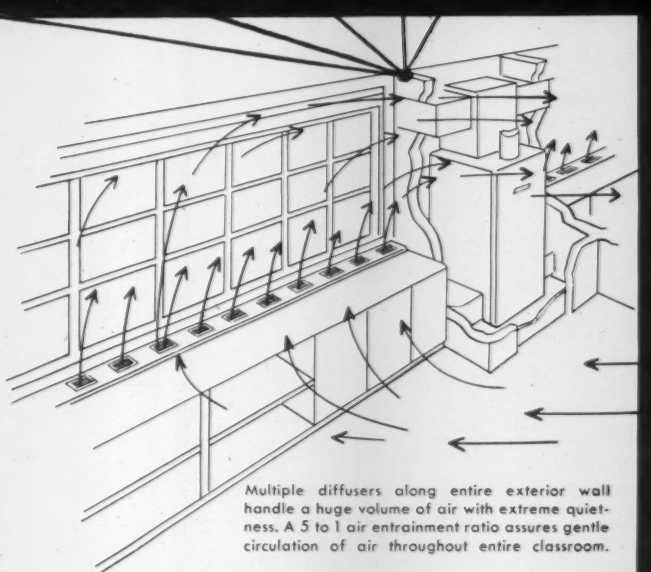
COST: $1.35 Sq. Ft. (Heating and Ventilating)

SPECIFIED: A modular Fresh Air Ventilating, Heating and Cooling System that lowered initial building costs and met all the needs for future expansion



St. John's High School, Jackson, Michigan
Myotte and Webb, Architects
Erwin Richardson, P. E.
East Lansing, Michigan

A LENNOX Comfort Curtain system completely ventilates, cools and heats this 15-Classroom addition, yet the cost per sq. ft. of the heating and ventilating was only $1.35. Gas fired heating sources, in approved construction heater rooms, are located on exterior walls between each two classrooms. An air processing unit in each room controls, blends and filters return and fresh air as demanded. This air is distributed continuously *across the full length of the classroom exterior walls* through functional, pre-finished metal bookshelf sections and wall ducts to eliminate cold spots, tired air and drafts. Individual Day-Nite thermostats maintain room temperatures within ½° of control setting. "No-occupancy" settings save fuel by recirculating warm air when fresh air is not required. Minimum structural requirements and ease of installation reduce both initial costs and over-all expenditures. As further building expansion occurs, modular design enables new units to be easily added. Comfort Curtain System provides for present or future air conditioning. Servicing can be handled by any qualified local heating contractor.



Multiple diffusers along entire exterior wall handle a huge volume of air with extreme quietness. A 5 to 1 air entrainment ratio assures gentle circulation of air throughout entire classroom.

For complete information about the Comfort Curtain System and its adaptability to in-the-room, two-room remote, central, hot water, steam, heat pump or electric heat sources, write LENNOX, 506 S. 12th Ave., Marshalltown, Iowa, or phone your nearest Lennox office, listed below, and ask for a Lennox technical representative to call.

World leader in indoor comfort for homes, business, schools and industry

LENNOX®

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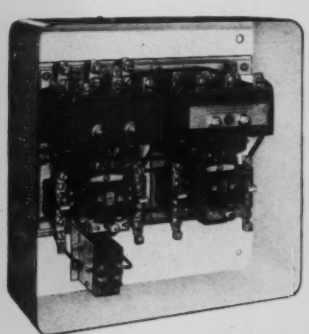
Brooks Memorial Union at Marquette University
Milwaukee, Wisconsin

One of two A-B Bulletin 736 part winding starters for the 100 hp motors used to drive the two Vilter compressors at Marquette University.



A-B Bulletin 736 part winding starters are made in ratings to 600 hp, 220 v; 900 hp for 3-point and 1200 hp for 2-point starting, 440-550 v.

For trouble free air conditioning Marquette University uses

ALLEN-BRADLEY MOTOR CONTROL

Since trouble free motor control is essential to trouble free air conditioning, it is only natural to find that more and more systems are being equipped with Allen-Bradley solenoid starters. The simple solenoid design — *exclusive* with Allen-Bradley in *all* starters up through Size 8 — has only ONE moving part. With virtually nothing to go wrong, you can depend upon *millions of trouble free operations*. There are no bearings to corrode and stick — no flexible jumpers to wear and break. And *all* A-B starters have double break, silver alloy contacts that are always in perfect operating condition and remain so — without attention — until completely worn away. In addition, A-B starters are equipped with two or three permanently accurate thermal overload relays to protect against motor burnouts.

For years of trouble free service, insist on Allen-Bradley — the motor control you can install . . . and forget!

Allen-Bradley Co., 1335 S. First St., Milwaukee 4, Wis.
In Canada: Allen-Bradley Canada Ltd., Galt, Ontario

ALLEN-BRADLEY Member of NEMA — Quality Motor Control

American-Standard Industrial Division Air-Lift in action

Plan by the piece--select

There are several advantages. One is
servation of time. You talk to produc
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selection, and can give you the latest
mation on new products and developn
and special equipment. Fewer interv
and fewer call-backs are necessary
other is one-source responsibility fo
entire job. You can cool, heat, and ven

by the package *with air conditioning by American-Standard*

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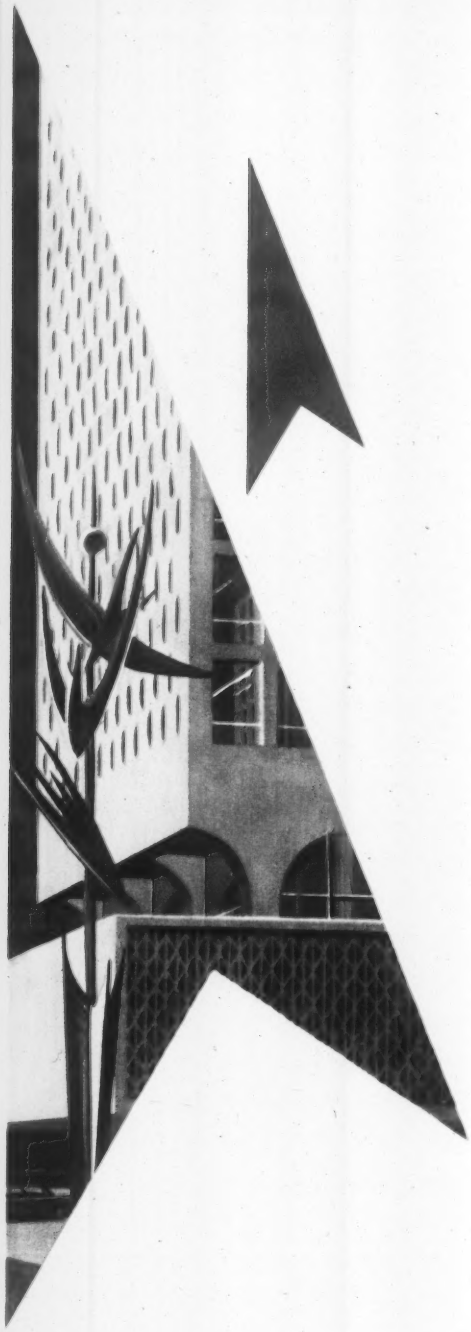
an entire office building, regardless of its size, with a complete package of products from boilers to air-handling systems and centrifugal refrigerating machines. You get an integrated system because the individual units are made to a uniform standard of performance and quality. Give your next office building an Air-Lift. Plan by the piece—select by the package . . . with American-Standard Industrial Division.



Air-Lift† for modern

office buildings

Air-Lift is a new concept of coordinated products and services from American-Standard Industrial Division. Through Air-Lift, you get one-source responsibility for all the year-round air-conditioning equipment demanded by today's new and renewed office buildings. Air-Lift helps you lift their efficiency through better control of the indoor climate.

Lift the flap

New from American-Standard

industrial division

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Heating	Firebox, Scotch-Type, and Package Boilers • Steam, Hot-Water, and Gas-Fired Unit Heaters Heating and Ventilating Units • Heating Coils • Cabinet Heaters • Industrial Heaters
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IT MAKES SENSE !

TO INSULATE UNDERGROUND PIPING WITH

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1 Introduction of a material such as expanded perlite into a granulated hard asphalt improves the insulating value of the blend.

2 Proper selection of asphalts by softening point to make up asphalt-perlite blends improves the insulating properties of the blend.

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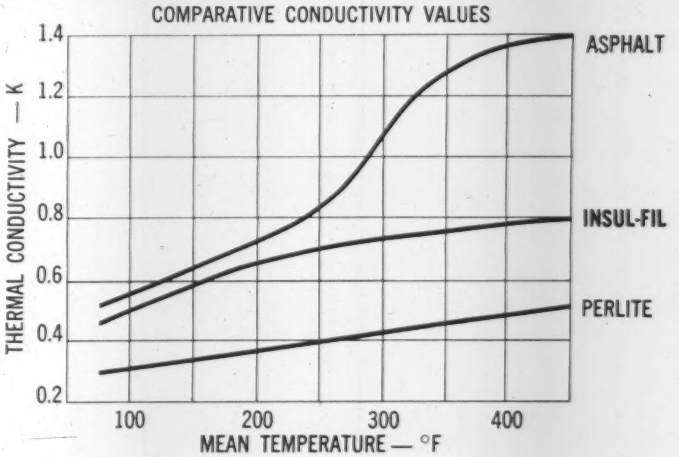


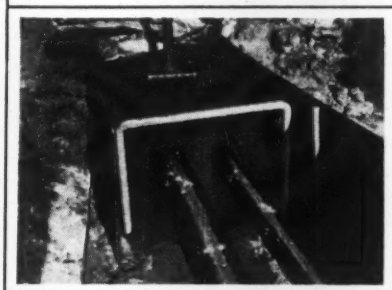
After years of extensive testing conducted at the Research and Development Department of The Atlantic Refining Company, these conclusions were presented in a Paper given before the American Chemical Society in Dallas, Texas, April, 1956. Since that time, hundreds of Insul-fil field installations have confirmed these conclusions.*

It is a well-known fact that the use of asphalt in construction created the necessity for the introduction of fillers (usually inorganic) of various types for the purpose of arresting the flow characteristics and improving the insulation value of the asphalts themselves.

The blend of hard granular asphalt and asphalt coated perlite gives Insul-fil its excellent insulating properties, water resistance and sufficient structural strength to the insulating body to resist normal soil stresses with the steam on or off.

An important Insul-fil development is the priming of the pipe with Accelerator #7591. The use of accelerator provides continuous adhesion of Insul-fil to the pipe, hastens consolidation, and gives additional protection against corrosion by galvanic action.

**Paper available on request.*



Insul-fil Is Simple To Install
Just pour it around the pipe to be insulated. Prod and tamp it in place and backfill. Heat introduced into the pipe forms the conduit.

Insul-Fil Company Inc.
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The most efficient Granular Fill Type Insulation for Hot Underground Piping

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"Zephyr"-25 "Zephyr"-50

New "Zephyr" containers for "Freon" —lighter in weight, easier to handle

These new "Zephyr" containers for "Freon" refrigerants are shorter, wider, lighter—so much easier to handle that a 50-lb. size is now practical. You can use them upright or inverted without special blocks or stands . . . stack them one on top of the other . . . stand them upright in your truck.

A permanent collar not only protects the valve, but also serves as a built-in carrying handle. And no wrenches are needed, because these new containers also have a new-type handwheel valve. Both "Freon-12" and "Freon-22", the premium-quality refrigerants, are available in these new Du Pont "Zephyr" containers.

New top and valve for standard 25-lb. cylinders

Now, Du Pont's new "Spintop", for standard 25-lb. cylinders, combines a convenient carrying handle, valve protector and stand, all in one. Free to rotate, the "Spintop" provides easy access to the valve. And the valve itself is a handwheel type that includes a special, spring-loaded pressure relief valve for added safety.

Complete family of containers* for "Freon" refrigerants includes the new "Zephyr" types; standard 10, 25 and 145-lb. containers; and the new "Spintop" cylinder. Your *leading* air-conditioning and refrigeration wholesaler stocks the type that suits your needs best. Call him today for your order of "Freon" refrigerants.

**1- or 2-lb. "Can-O-Gas" containers of "Freon" refrigerants are available from the Virginia Smelting Co., our nationwide sales agent and authorized repackager.*

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premium quality
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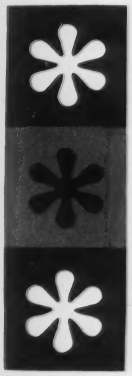


The Case For Air Conditioned Schools

On June 29, 1960 a seminar on "Improving the Learning Environment" was presented in New York City under the sponsorship of Carrier Corp. Three educators and a professional architect-teacher were on the program. Their remarks, some of which are summarized *below, constitute solid arguments for the educational and economic soundness of the present trend toward year 'round air conditioning in the nation's schools.*

Dr. William R. Flesher, *chairman of the seminar, past president of the National Council on Schoolhouse Construction, consultant to the Committee for the White House Conference on Education, professor and research associate at Ohio State University.*

The nation is showing progress in reducing its backlog of schoolroom need. 36,000 classrooms were built in 1949-50. Almost double that number were constructed in 1957-58. Between these dates enrollments rose 33 percent, but new construction increased 96 percent. Even with all this new construction, however, 140,500 additional classrooms were still needed in the fall of 1958.

There is another question besides that of mere walls and floors and roofs. Increasing emphasis has been placed on BETTER classrooms; those which are more healthful, more functional, more attractive, and more comfortable. This qualitative challenge is the subject of this seminar — the improvement of the learning environment with regard not only to its physical qualities but also and with special emphasis on the effects of better surroundings on pupils and teachers.

Why Air Condition Schools?

Eva G. McDonald, *for 17 years an elementary school teacher in Alton, Ill., the last four of which have been in that community's gifted student program. Life member of the National Education Association.*

I have had the experience of changing, in two years, from an uncontrolled to a controlled teaching environment and back again. The favorable reaction of teachers and students to the air conditioned building was apparent, but something more than informal comment seemed necessary.

I developed a questionnaire for some 20 teachers in Alton, and to broaden this I interviewed some 150 teachers, administrators, supervisors, board members, and city personnel connected with air conditioned schools in San Angelo, Texas, and Hobbs and Roswell, New Mexico, as well as Alton. I also asked for pertinent comments not covered in the questionnaire.

The important requirements which appeared, and which are interrelated, are:

1. Comfortable seating in a room of adequate size and shape.
2. Control of lighting and the visual environment, including elimination of outside distractions, and adaptability to audio-visual techniques.
3. Control of sound and noise.
4. Control of the thermal environment and the cleanliness of the air.

Considering these factors in the above order — today's requirements are for flexible seating providing at least 30 sq ft per pupil, but not necessarily in oblong rooms with conventional arrange-

ments. Windowless classrooms in Hobbs and Roswell produced a new freedom of arrangement without regard for window and light sources. A circular school in San Angelo had movable furniture and walls, with an auditorium in the center of the building. Such flexibility is not possible where there is concern for use of windows as ventilation or light sources.

Air conditioned schools use a wide variety of window arrangements. Some have the usual windows with venetian shades supplemented by skylights, some have small high windows, and some no windows at all. In New Mexico the problem of excessive glare from both north and south due to the lack of greenery has been solved in some schools by the elimination of windows and the substitution of two-color lighting arrangements to produce an artificial sunlight equivalent.

Teachers have commented that the windowless structure affords perfect visibility, complete blackout when necessary, and better concentration because of lack of distractions.

Schools with few or no windows allow teachers to make immediate use of visual aids without the usual time wasting adjustment of shades, screens, and seating. Greater amounts of work space are available around all four walls.

Disturbances from the outside, visual and audible, can be controlled where windows are eliminated or kept closed. With hallway doors closed, interior noises can be excluded. Sound producing activities can be carried on without disturbing others in the building.

The results of my questionnaire, which was answered by 125 teachers, indicate that less fatigue and more aggreeable attitudes brought about by air conditioning mean more and better work. 81 percent said air conditioning gave them more time for the class, for reasons indicated above. 92 percent thought they could, with air conditioning, introduce new subject matter at any time, whereas uncomfortable surroundings always meant waiting for cooler weather when the attention-span would be greater. In a controlled environment, response can be good throughout the day where before there was a noticeable drop between the first and last hours.

Cities operating summer schools find noticeable increases in attendance in air conditioned buildings.

Economies of Air Conditioning

Dr. Paul A. Miller, *Superintendent of Schools, Syracuse, N.Y.*

My report will consist of two parts: the first dealing with a school we are building which will give us superior school housing while reducing cost; the second with a questionnaire to fellow superintendents on the subject of facilities and costs.

The school is the F. Ware Clary Junior High School, in Syracuse, which will be fully air conditioned even though we live in the snow belt. This came about because Syracuse is building schools at the rate of $1.25 million a year and we must be concerned with real economy and good education. We wanted more space for less money.

We remembered that a square contains more space per lineal ft of perimeter than any other rectangle. Square rooms could mean a real saving in wall costs. Now classrooms have been traditionally along outside walls. Grouped in a square, many no longer adjoin the wall. How would we handle the ventilating problem? We thought of air conditioning, and discovered that air conditioning was more than cooling or heating. We found that it meant providing tempered air, with a consistently controlled climate, including the right temperature, humidity, and degree of cleanliness.

Two plans were evolved and bid, one for a conventional non air conditioned design, the other for a new compact air conditioned plant. We found there would be savings in general construction, including less wall and interior partition footage, shorter plumbing and electrical lines. Even with the cost of the mechanical equipment we found we would save $54,500. There are other savings, including land, easier maintenance, and less glass breakage due to fewer windows. The lower operating expenses balance the cost of the mechanical equipment, and we still have the initial construction savings. (For further discussion of the F. Ware Clary School, see *You'll Want to Know*, Feb., 1960)

We have had many inquiries on this subject. One superintendent made the good point that if climate control is good in the snow belt, it is more so in the sun and dust belt. I feel that future physical and educational approaches to schools will be different than they are today. Educational TV, different teaching methods, increasing construction and land costs, a general awareness of the need to eliminate outside distractions, and increasing summer sessions; all will demand a flexibility and adaptability that will require air conditioning. But of the superintendents answering my questionnaire, only one in five had really investigated relative costs involved in air conditioning. Fifty-nine percent think air conditioned schools cost more. Yet more than 80 percent say it will improve pupil and teacher performance and attitude.

Design for the Future

Walter T. Rolfe, *F.A.I.A., former chairman of the department of architecture, University of Texas, co-founder of Golemon & Rolfe, Houston, designers of more than 70 schools. Mr. Rolfe presented a history of school design, and illustrated some designs for new schools in various parts of the country.*

I WAS a part of an architectural

(*Continued on page 217*)

AWS Tells Plans For Fall Meeting

THE American Welding Society National Fall Meeting in Pittsburgh Sept. 26 through 29 will include 17 technical sessions at which some 51 papers will be presented, according to a report from the AWS information center.

In order to afford participants with the maximum opportunity to obtain complete coverage in any one area, each scheduled session will deal with a particular process or subject, at which all pertinent papers will be presented.

The following subjects are scheduled for the meeting: resistance welding, brazing, electrodes and techniques, weldability, aluminum, high alloys and fabrications of weldments, and others.

Several plant tours including a visit to the Duquesne Light Co.'s Shippingport Atomic Power Station have also been arranged.

Purdue University Dedicates New Environmental Research Lab

MORE THAN 160 persons, including many leaders of the air conditioning industry, participated in the recent dedication ceremonies celebrating the opening of the Herrick Laboratories for Refrigeration and Climate Control at Purdue University, Lafayette, Ind. Among those attending were representatives of the 24 manufacturing firms which contributed to the million-dollar project.

The laboratories will provide facilities for basic research in air conditioning and refrigeration directed toward the study of environmental effect upon man and animals. The facility is named for Ray W. Herrick, chairman of the board, Tecumseh Products Co., who was the principal donor.

Dr. Frederick L. Hovde, president of the University, formally accepted the new building from Walter Scholar, architect.

Sponsors of the facility are Acme Industries, Inc., Surface Combustion Corp., Worthington Corp., Carrier Corp., Westinghouse Electric Corp., The Trane Co., Minneapolis-Honeywell Regulator Co., Frick Co., Sporlan Valve Co., Dunham-Bush, Inc., Whirlpool Corp., Bell & Gossett Co., Johnson Service Co., Peerless Corp., The Dole Valve Co., Addison Products Co., Revco, Inc., Stubnitz Greene Corp., Chrysler Corp. Airtemp Div., Dupont Chemical Corp., McMillan Feed Mills, Ralston Purina Co., Quaker Oats Co., and Tecumseh Products Co.

FACULTY MEMBERS AND GUESTS at the dedication of Purdue University's Herrick Laboratories included (l to r) Dr. George A. Hawkins, dean of engineering, Prof. Paul Chenea, head of the school of mechanical engineering, Melvin A. Ramsey, Worthington Corp., William F. Freije, principal of firm which built test chambers, and Prof. Harry Solberg, associate dean of engineering

you'll want to know

Prospect for 60's: Auto-Controls Boom

MORE INNOVATIONS and improvements in the field of automatic temperature control will be produced in the next decade than have appeared in the past fifty years, according to Joseph A. Cutler, president of the Johnson Service Co.

Within another 20 years, he said, virtually every building of any consequence in the nation will be air conditioned and will have all controls necessary for complete regulation of interior environment. He cited the keen competition within the controls industry as a factor which will accelerate the introduction of new and improved devices, and noted that owners are increasingly willing to accept new ideas in this area.

Constant study by the industry has already resulted in more efficient means of heating and air conditioning system control, he said, and cited the development of the pneumatic control centers produced by his own firm that afford instant checking of many temperature points from a central location.

One area in which a breakthrough is long overdue, according to Mr. Cutler, is that of humidity control. In spite of the fact that control devices have long been available, most owners have been unwilling or unable to shoulder the extra cost burden connected with proper humidity regulation, with the result that many buildings still do not attain the full comfort potential available. Increasing interest in the importance of humidity, he said, as evidenced by the weather bureau's "temperature-humidity index" foretells an early end to this situation.

you'll want to know

Plastic Pipe Division Meets For Review

THE Thermoplastic Pipe Division of The Society of the Plastics Industry, Inc., met recently in Miami Beach to review the division's research and education program, reports George H. Reed, chairman.

The purpose of the review was to determine in which areas additional long term industry activities were indicated. Mr. Reed and vice chairman John Lainson noted the progress made in the last few years towards the development of standards, specifications, testing, and education. They stated that the work of the Plastic Pipe Research Council, now in its fourth year, becomes more and more important as new applications and materials are developed.

Committees within the American Standards Association are at work on proposed standards for polyvinyl chloride socket type and screwed fittings. The Thermoplastic Pipe Division has selected a fourteen member committee to supervise and advise on such work as the preparation of an engineering manual for plastic pipe, the continuing work of the Plastic Pipe Research Council, and the implementation of state and municipal level code work.

NASA Head Lauds Young Engineer Program

DR. T. KEITH GLENNAN, Administrator of the National Aeronautics and Space Administration, has emphasized that the training and development of young engineers in this country is of major concern to the nation, according to the Engineers' Council for Professional Development. The Council is headed by W.L. Everitt, Dean of Engineering at the University of Illinois.

Dean Everitt met recently with Dr. Glennan to discuss a program intended to help guide young engineers towards professional maturity. The Council has developed the program to combat the "post-college slump" experienced by engineers. It consists of a Five Years plan to bridge the gap between graduation and later professional endeavors. A series of utilization conferences is being held to review methods by which local groups of employers of young engineers may establish local programs of their own. The review conferences are sponsored by the Office of Civil and Defense Mobilization.

J. H. McCauley, Jr. Heads Chicago Mechanical Contractors

IN accepting the gavel as the incoming president of the Mechanical Contractors Chicago Association, J. H. McCauley, Jr., president of James H. McCauley & Sons, Inc., pointed with pride to the many accomplishments of the first such organization of heating, piping, and air conditioning contractors in the U. S. He praised the effectiveness of the previous leaders who have given so generously of their time and efforts and paid particular tribute to Paul H. Kroeschell, president of Kroeschell Engineering Co. who served as president from July 1957 to June 1960. In recognition of this service, Mr. Kroeschell was presented a scroll, and luggage.

Mr. McCauley reflected optimism about the future and assured some 300 contractors, consulting engineers, manufacturers, and other guests at the association's 72nd annual dinner that the mechanical contracting business in the Chicago area and in the nation had a great potential and would surely continue to grow in the near future. He cited many "firsts" for the Chicago association and pointed out the importance of maintaining this leadership and standing. He told how the pipe welding bureau was incorporated in Chicago in 1940 and how at the start of World War II it had available 427 certified pipe welders for the war effort compared with 20 from the rest of the nation. The Chicago apprenticeship training program became the model for the nation. So it has also been in other areas of the mechanical contracting business in the Chicago association.

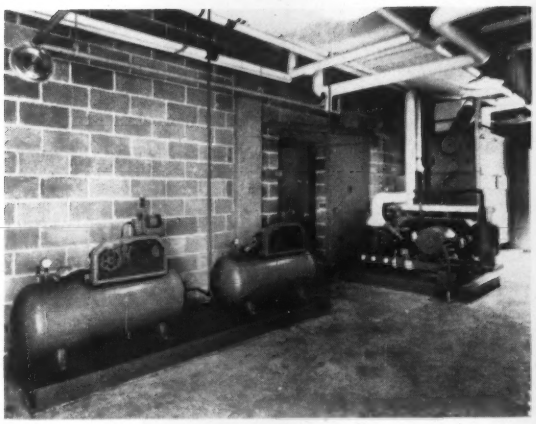
Joseph H. Kearney, president of the Mechanical Contractors Association of America and a member of the Chicago association, said this meeting was his first visit as national president to a local association. He urged all mechanical contractors to refrain from cooperating with general contractors who "bid shop." He said mechanical contractors who fail to get a dollar in payment for a dollar's worth of business are not meeting the principles of sound business.

Mr. Kearney also spoke directly to the manufacturers represented at the meeting and pointed out the fallacies of extending their credit to contractors beyond a reasonable length of time.

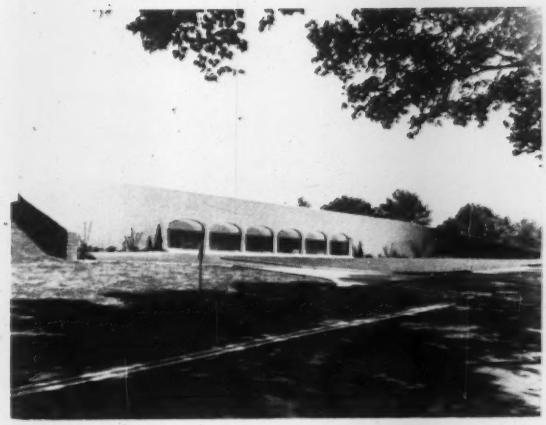
Speaking to the consulting engineers, he urged them to stick to their plans and specifications and not approve lower quality products requested by price-cutting contractors.

Recognizing the extensive travel schedule Mr. Kearney is expected to follow this year during his presidency of the MCAA, he was presented with a hammock to assure him that he would get his rest wherever he may be.

Other officers of the Chicago association are: William Pope, vice president; C. E. Crone, treasurer; S. L. Haas, secretary; and E. R. Teske, executive secretary.



COOLING EQUIPMENT includes reciprocating compressor and evaporative condenser seen in background



FRONTAL FACADE of new fire alarm center is only part of building which is above ground

Underground Fire Alarm Center To Be Air Conditioned

THE NEW St. Louis Fire Alarm Center, scheduled for completion next year, is the result of several years of study and planning initiated by a strong civic desire to modernize the city's safety services. The center will incorporate all fire alarm activities within a single building, and is designed to allow for future expansion as dictated by the growth of the population served and of the metropolitan district, according to Curtis Mfg. Co.

The entire building, with the exception of a frontal facade, has been placed below-ground, with 16 in. of earth covering the top. Such a design was chosen for several reasons. St. Louis is located in a tornado belt, and has been struck by two major tornadoes within the last 25 years. The structure would also provide protection in the event of a nuclear conflict or other national emergency. Greater structural security, ease of exterior maintenance, high resistance to fire, and easier climate control are also cited as advantages gained by the design, besides which the building is intended to be as unobtrusive as possible, due to its location in the corner of a city park.

The building contains three principal areas: the middle switchboard center and dispatching room, an electrical-wiring and equipment area, and a third space containing heating and air conditioning mechanical equipment. Other areas are provided for repair and maintenance facilities, office space, a visitors' area, a kitchen, and personnel locker room. All alarms will be received at the center position, from which notification will be made to appropriate fire stations. Twelve in. reinforced concrete was used for the outer shell of the structure, which is sheathed in a waterproof membrane and surrounded by earth.

One intake and three exhaust penthouses top the structure. Additional outdoor air intake is provided through a louvered opening in the facade.

Incoming air is filtered by means of glass fiber rolls. Modification plans are provided for conversion of the filter unit for radioactive separation if necessary. A smoke gage installed adjacent to the filter will stop the system if smoke is present in either the outdoor or recirculation air.

Two oil fired boilers provide steam to heat exchangers for heating the incoming air when necessary. Cooling is accomplished by means of a 30 hp reciprocating compressor with an inside evaporative condenser, located in the mechanical equipment area. Remote heat exchangers receive refrigerant No. 12 for air cooling. Final air distribution is through ducts to diffusers located throughout the building.

Because of the large amount of electrical equipment contained in the structure, including 200 automatic telephone lines, a relative humidity of from 40 to 60 percent is maintained at all times. Recirculation varies according to the outside temperature. At 75 to 80 F, 100 percent outside air is distributed. At 0 and 100 F temperature extremes, only 5 percent outdoor air is admitted to the system. Fans for air distribution are located in a room on the mechanical equipment side of the building. The three exhaust penthouses and single intake mounted on the roof are of concrete, but would be converted to steel structures in the event of a military crisis.

Conduit containing the 1172 miles of telephone and telegraph

wires which serve the center is kept under 6 psi pressure at all times to prevent water and foreign matter seepage into the line. A ¾ hp compressor provides the necessary air pressure for this function, and an identical unit is used as a standby and to furnish 65 psi air to 11 cleaning jets built into the various sections of the building. An integral alarm system would use the air pressure to signal any break in the line.

Announce Publication of Air Pollution Manual

THE American Industrial Hygiene Association has announced publication of its Air Pollution Manual, Part 1, an evaluation of the nature and effect of industrial pollutants and their by-products such as odors.

In the first chapters the manual presents a short summary of existing laws dealing with air pollution in the 50 States, Puerto Rico, the Virgin Islands, and the District of Columbia, a discussion of community relations in regard to the selection of new plant sites and the control of pollution from existing plants, and a statistical section on particulate concentrations in various urban and non-urban locations.

The effect of air pollution on human, animal, and vegetative substances is next discussed, with specific mention of various pollutant compounds, followed by a chapter on the economic effects of pollution and additional chapters on community procedures, stack sampling, and a review of the chemical substances involved.

The nature and analysis of odors and radioactive substances and the control of these factors is also considered, and the manual closes with a discussion of meteorological effects on the problem.

30-Year Old Post Office To Be Air Conditioned

A one and three-quarter million dollar year 'round air conditioning system will soon be installed in the 500,000 sq ft Post Office and Federal Building in Newark, N. J., according to Engineers, Inc., designers of the installation.

One objective of the system design is to accomplish adequate zone control throughout the building with as little visible alteration as possible, and without major structural changes.

The installation will incorporate a high velocity air distribution system using 6 and 8 in. diameter ducts, with air handling units installed in available attic spaces. Compressors will be installed in the building's basement, and existing walls will conceal the cooling tower located at the rear of the building on the roof of the third floor.

A central control system will operate from a basement site to provide year 'round heating, ventilating, and air conditioning. A capacity for simultaneous heating and cooling of different zones will be a feature of the system.

The 30-year old stone and masonry building is occupied by Federal Courts, the city post office, FBI, and other governmental agencies.

New Sound Lab Tests Air Conditioning Equipment

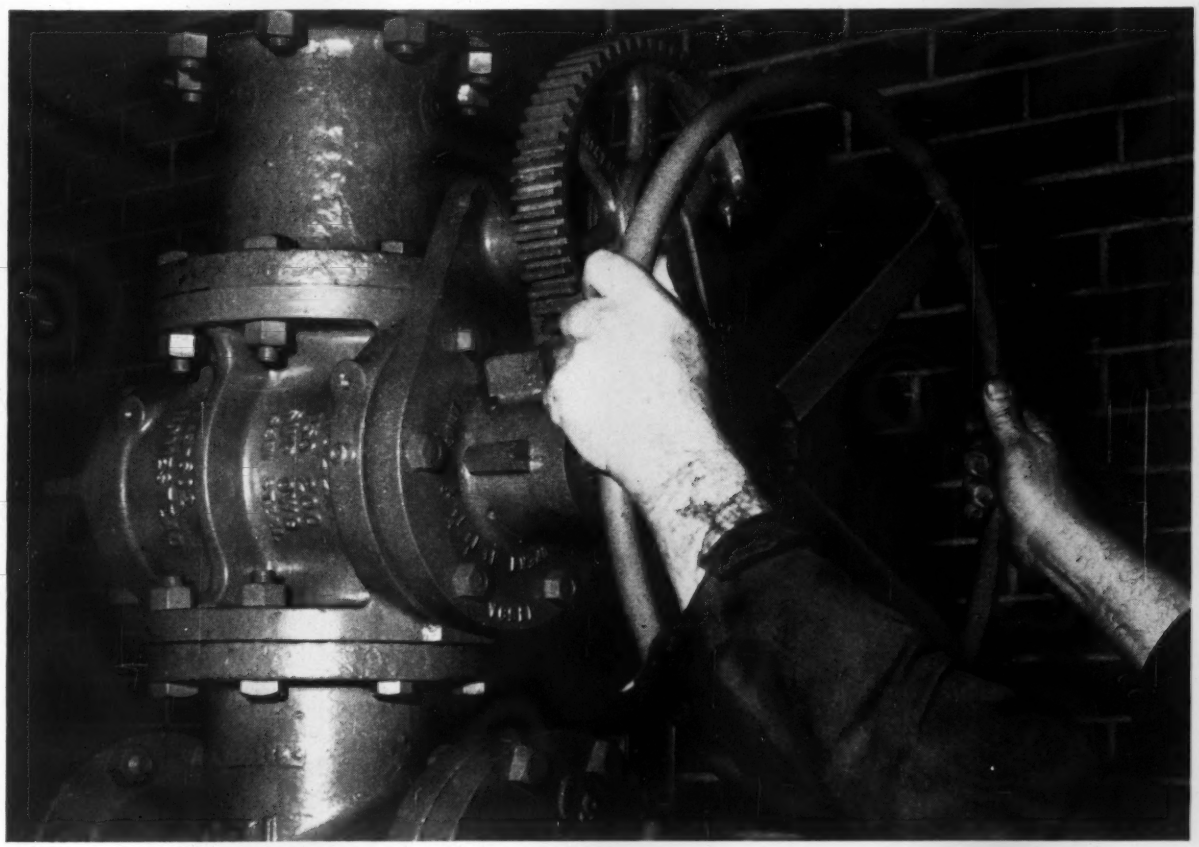
A NEW SOUND and vibration laboratory, called a "Reverbatorium" is now in operation at the York, Pa., plant of the York Division of Borg-Warner Corp.

The laboratory consists of two poured concrete chambers, 36 by 28 by 20 ft and 25 by 19 by 15 ft, respectively. The chambers were cast together and are entirely supported by steel springs. Thus, although the facility is annexed to the company's research and engineering laboratory, it is completely isolated from the concrete building which surrounds it.

The chambers were constructed with non-parallel walls, ceiling, and floor. This design serves to slow the decay rate of noises produced within the enclosure, affording better analysis of generated frequency patterns. Vibration analysis and data reduction equipment installed in the laboratory include instruments for the measurement of sound, vibration, balance and strain.

100% FLUID CONTROL AT YOUR FINGERTIPS

with Homestead Lubricated Plug Valves. When open, they provide full pipe-sized passage to fluids. Closed, their controlled high pressure lubricant



system, plus extremely close plug and body tolerance, guarantee a complete chemical seal—positive shut-off without contamination of line fluids. Instant response is sure, too, because piston-like movement of plug during each lubrication prevents sticking. They are low in first cost—low in upkeep. Write for complete details.

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HOMESTEAD VALVE MANUFACTURING COMPANY
P.O. Box 193, Coraopolis, Pennsylvania

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Gentlemen: Please send me Catalog 39-1 and prices on Homestead Lubricated Plug Valves

Name..... Title.....

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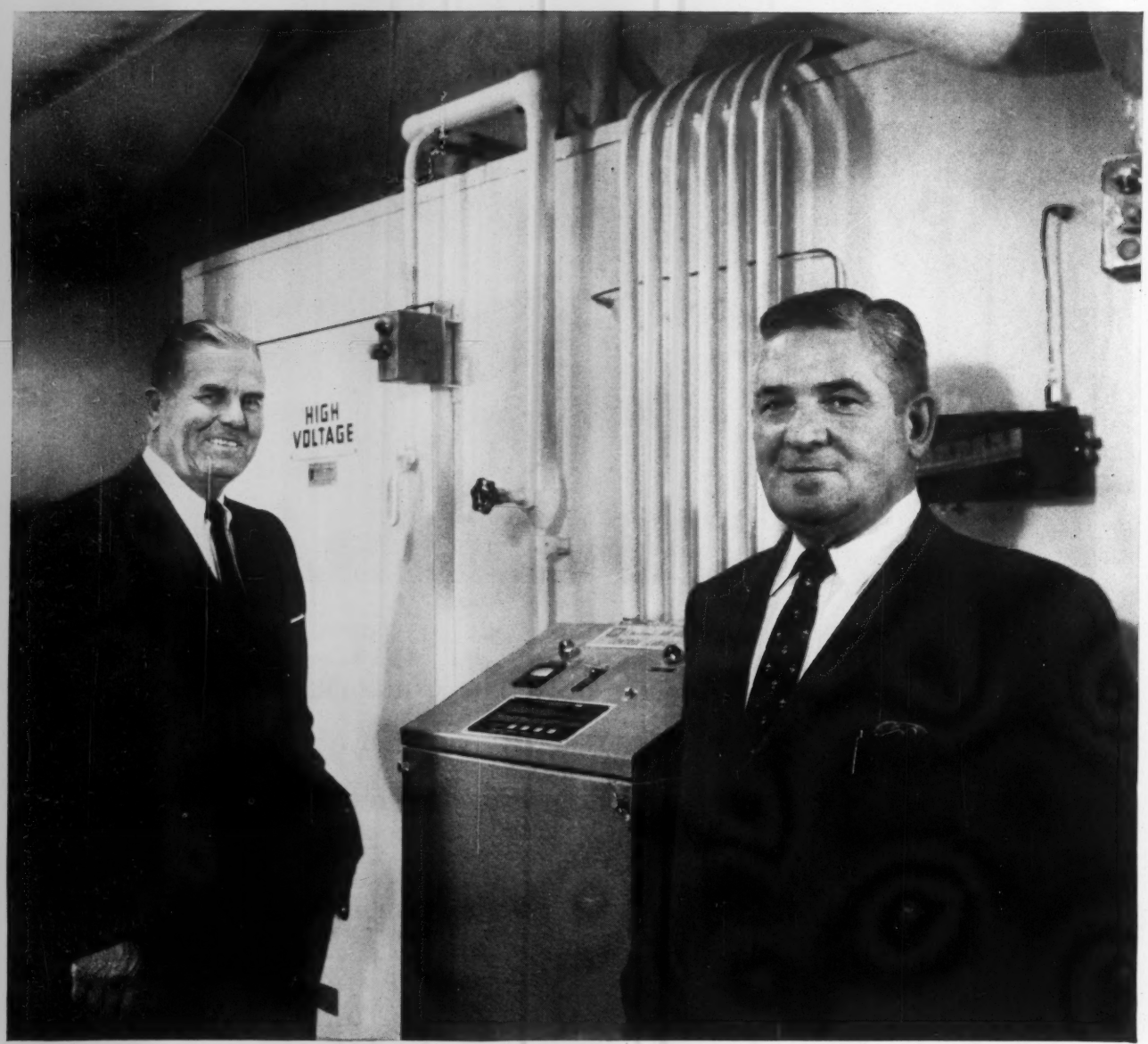
City..... Zone..... State.....

Mr. A. B. Carter and Mr. S. P. Wallace, mechanical contractors for the new Southland Center in Dallas, say:

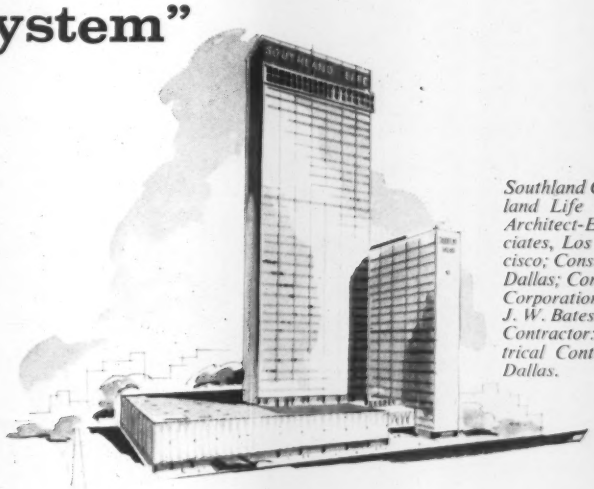
"Honeywell took all the headaches

largest electronic air



Mr. A. B. Carter (left) and Mr. S. P. Wallace in front of a Honeywell Electronic Air Cleaner—one of 17 installed in Southland Center.

out of installing the southwest's cleaning system"



Southland Center, Owner & Builder: Southland Life Insurance Co., Dallas, Texas; Architect-Engineer: Welton Becket & Associates, Los Angeles, New York, San Francisco; Consulting Architect: Mark Lemmon, Dallas; Construction Supervision: Vanguard Corporation, Dallas; General Contractor: J. W. Bateson Co., Inc., Dallas; Mechanical Contractor: Farwell-Wallace, Dallas; Electrical Contractor: Fischback and Moore, Dallas.

Honeywell engineers saw that the equipment was delivered on time—then supervised the installation and thoroughly tested the system to make sure it operated perfectly!

"You can't beat Honeywell's field service organization," agree the contracting team of A. B. Carter and S. P. Wallace. "Honeywell had *project engineers* at the job site from the very beginning. And they stayed on the job until every Electronic Air Cleaner was delivered, installed and checked out at top efficiency!"

Honeywell installed 17 Electronic Air Cleaners in the new $35-million Southland Center. The installation is the largest in the southwest and one of the biggest in the world. It removes 90 per cent of all airborne dirt, to cut cleaning and redecorating costs—supply pure, healthful air throughout the building at all times.

Honeywell also provided the entire temperature control system for Southland Center. The air conditioning plant is the largest of its type now installed in an office building. 1300 thermostats offer individual room temperature control. And two Honeywell Supervisory DataCenters* provide centralized control of public spaces and the vast heating and air conditioning system.

You'll find your job—large or small—much easier when you work with Honeywell. Help is always conveniently available from any one of 112 offices across the nation. Call your local Honeywell office. Or write Honeywell, Dept. AC-8-67, Minneapolis 8, Minnesota. **Trademark*

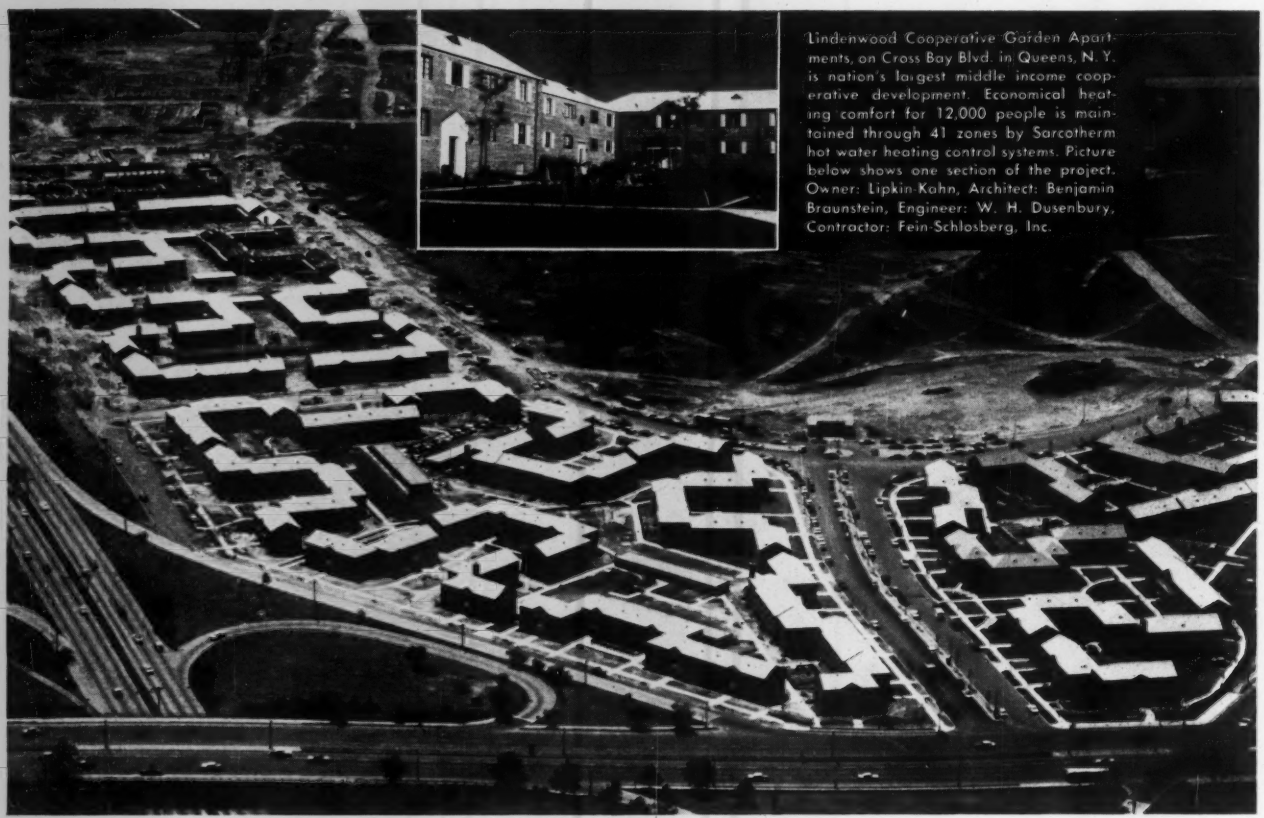
Honeywell's electronic air cleaning system will keep Southland Center bright and new-looking for years at lowest cost.

Honeywell

First in Control

SINCE 1885

75th YEAR PIONEERING THE FUTURE



Lindenwood Cooperative Garden Apartments, on Cross Bay Blvd. in Queens, N. Y. is nation's largest middle income cooperative development. Economical heating comfort for 12,000 people is maintained through 41 zones by Sarcotherm hot water heating control systems. Picture below shows one section of the project. Owner: Lipkin-Kahn, Architect: Benjamin Braunstein, Engineer: W. H. Dusenbury, Contractor: Fein-Schlosberg, Inc.

$40,000,000 PROJECT MAINTAINS EVEN, ECONOMICAL HOT WATER HEATING WITH SARCOTHERM CONTROL SYSTEM

The Sarcotherm Weather Compensated heating control system installed at the new Lindenwood Cooperative Garden Apartments in Queens, New York, assures its residents even, reliable heat regardless of outdoor temperature. The engineer, William Dusenbury, worked out with Sarcotherm specialists a system that provides for continuous, modulated hot water flow. This system also handles night setback and morning pickup automatically, requiring no supervision.

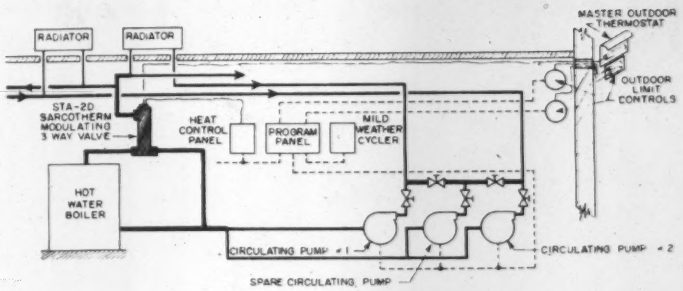
An outdoor bulb, sensitive to change in outdoor temperature, controls a 3-way mixing valve, which regulates the temperature of the hot water supply to the system, in accordance with outdoor temperature changes. For example, at an outside temperature of 0°F., heating water is delivered at 200°F. An outdoor temperature of 65°F. sets the *water* control for 110°F. When the outside temperature exceeds 65°F., the Sarcotherm BA-4C High Limit Pump Control shuts off the heating system automatically. The PBA-2 program panel, especially designed by Sarcotherm engineers for apartment control, provides automatic heat programming. Comfortable, even heating is maintained in all 41 zones in the group of apartments.

The entire installation of the control system was supervised by Sarcotherm Controls, Inc.

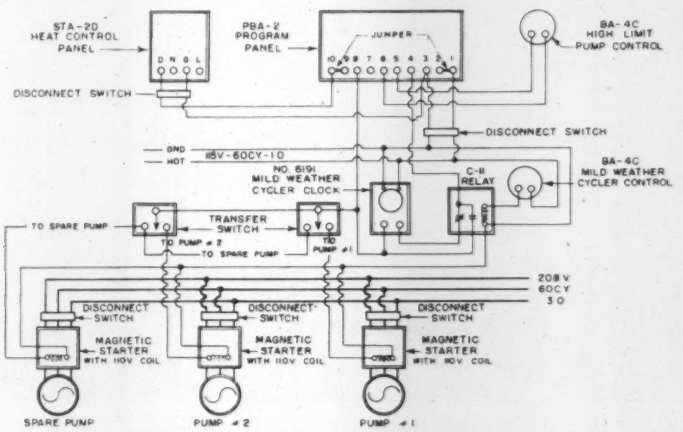
Write for Sarcotherm Technical Literature. Please specify steam or hot water.

SARCOTHERM

SARCOTHERM CONTROLS, INC.,
AN AFFILIATE OF SARCO COMPANY, INC.,
635 MADISON AVENUE, NEW YORK 22, N. Y.
PLANT: BETHLEHEM, PA.



Schematic hook-up of Outdoor-Indoor Sarcotherm Control System



Schematic wiring diagram for Sarcotherm Control System

. . . AND THESE SIMPLE, ACCURATE, AND RUGGED SARCOTHERM CONTROLS WERE EASY TO INSTALL . . . EASY TO MAINTAIN

Sarcotherm unit-packed and tagged every component and keyed all parts to installation diagrams and blueprints — substantially reducing installation time. On-the-job supervision by trained Sarcotherm personnel added materially to the efficiency of the job.

After installation, another Sarcotherm standard policy helped to make field adjustments easy. Sarcotherm provided complete operating and adjusting instructions, both verbal and written, to maintenance personnel.

Lindenwood now has a virtually maintenance-free control system. This project is profiting from the soundness of Sarcotherm design and operating methods developed through two decades of specialized experience. 1792

* *FOR COMPLETE CONTROL SYSTEM CATALOG* write Sarcotherm Controls, Inc., 635 Madison Ave., New York 22, N. Y.

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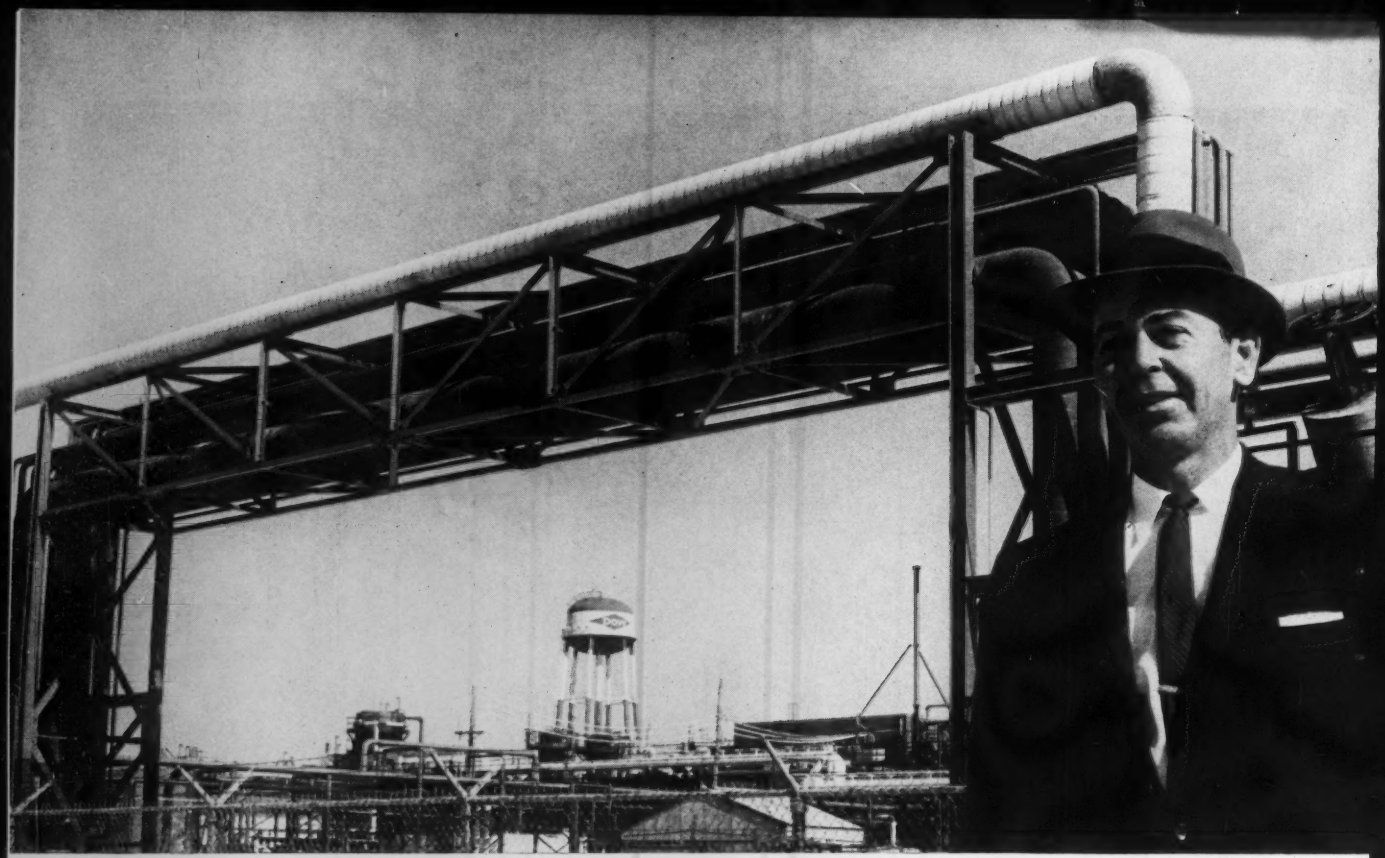


C. V. Harp, Houston, Texas District Office Manager, Reliance Electric and Engineering Company

"This new Duty Master goes three vital steps ahead in open motor protection.

"Right now the big story on open motors is encapsulation, for new protection against dust, dirt, acids, water and other contamination, indoors and out. The Reliance story adds something more.

"As step 1, read why Duty Master's 'thixotropic' process gives you better heat dissipation without cracking . . . in contrast to the thick, monolithic mold encapsulation now applied to other open motors. This is a definite design advance.

"As step 2, read about a new protective film coating of rotor and stator—to stop rust and 'freezing' in the air-gap. Another Reliance advantage.

"As step 3, get the story on complete shielding and water-repellent lubrication of bearings. Reliance design does the trick.

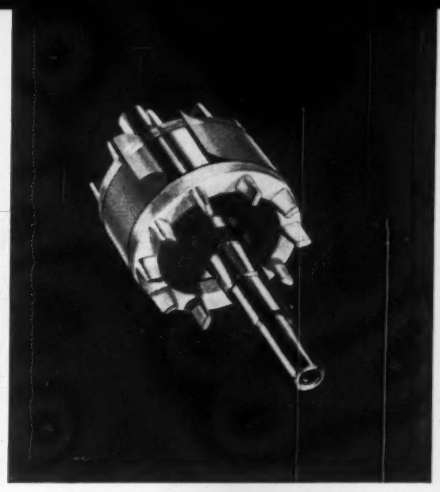
"The facts on the opposite page tell you all about Duty Master's complete open motor protection.

"You buy more than a motor when you buy this exceptional Duty Master."

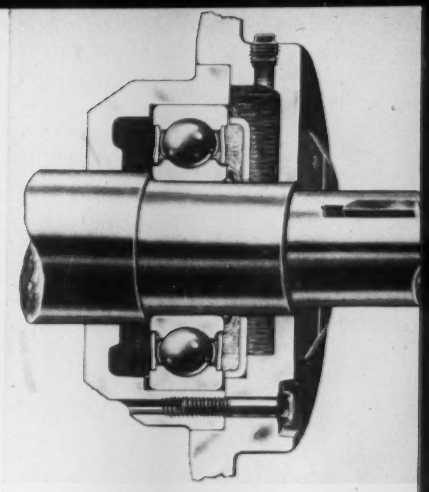
B-1660-A

RELIANCE — R — Duty Master A-C. MOTOR

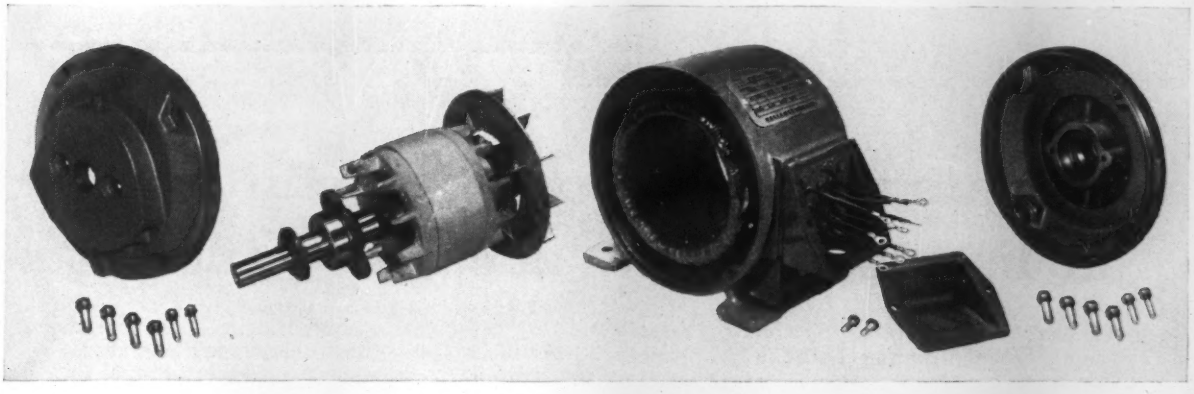
Duty Master encapsulated windings are not in a molded, monolithic block as many motors are. The epoxy resin is vacuum impregnated into the windings, penetrating completely and forming a solid mass following the contour of the windings at a uniform thickness of ⅛ inch. Better cooling results because there is no bulky mold to inhibit dissipation of heat; further the epoxy supports the expansion of copper and iron without cracking. Method provides maximum flexibility, tensile strength, bond strength and still maintains resistive strength.



On these applications, the air gap between stator and rotor is a highly vulnerable area . . . consequently we took steps to prevent problems which would impair operation of the motor. Reliance devised a protective film to coat rotor and stator laminations and to remove the possibility of rust or 'freezing.' This film stays put . . . water, dust, dirt, or acid won't affect it . . . and it marks another step in over-all open motor protection. Downtime and maintenance costs are cut.



Bearings are double shielded—a slinger on the outside and a moisture-resistant inner cap keeps out water and other contaminants. Bearings are also prepacked in a special non-washing grease, which not only prevents rust, but will not wash out. Reliance's exclusive "Metermatic" lubrication system automatically meters correct amounts of grease to bearings from a large reservoir, and as the diagram shows, puts grease on *both sides* of the bearing.



Cast iron conduit box is threaded . . . has neoprene gasket providing a liquid-proof seal. Leads are individually held by molded pressure knobs numbered to correspond with wiring diagram. Box may be rotated to suit customer's convenience.

All motor bolts are zinc plated, hex-head . . . resist corrosion and assure positive wrench grip. Contact edges of end shields are greased to assure a completely tight seal.

Your Reliance Sales Engineer has all the details. Get in touch with him at the nearest office, or write us for Bulletin B-2108.

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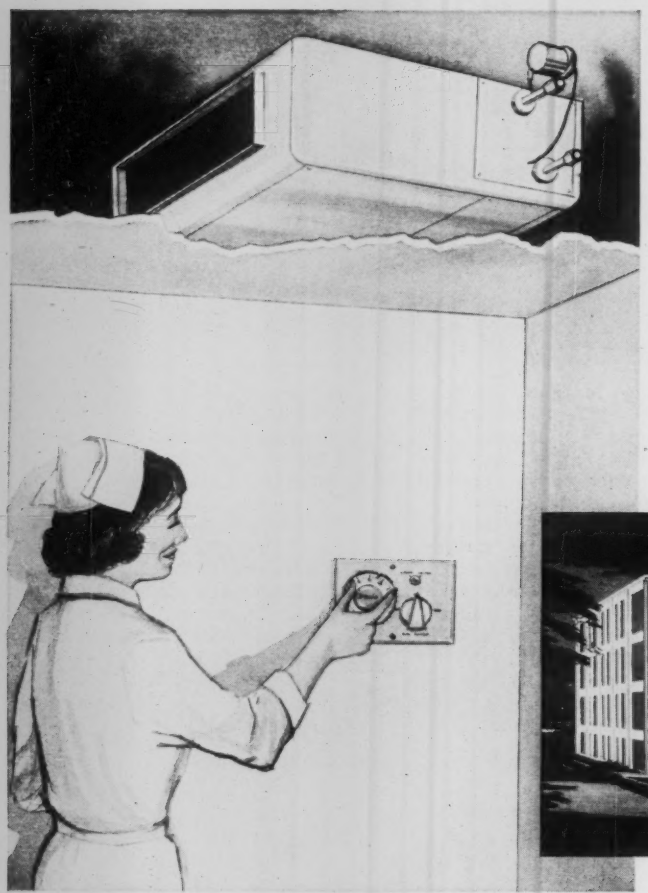
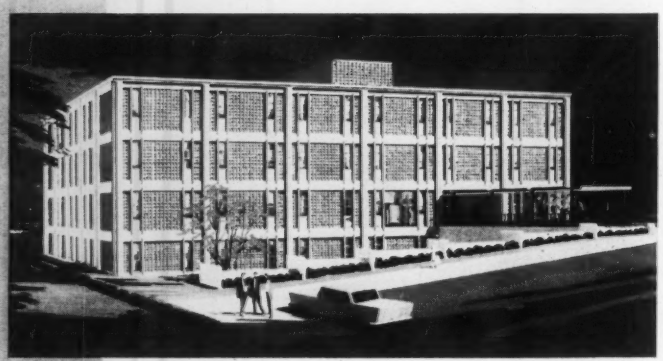


DOCTORS NORTH-ROADS BUILDING
Dellwood, Mo.

Architects: Smith & Entzeroth
Mechanical Engineers: Albert Rich Co.
General Contractor: Cousins Construction Co.
Mechanical Contractor: Condaire, Incorporated



Unique use of *Marlo* fan-coil units in handsome new doctors' building

The versatility of Marlo "Seazonaire" remote room air conditioning units is graphically demonstrated in the new Doctors North-Roads Building in suburban St. Louis.

In this installation, the "Seazonaires" were recessed above a removable furred ceiling and equipped with flexible ductwork leading to ceiling diffusers. Thirty-six "Seazonaires" were installed, one unit for each suite, each with its own thermostatic and fan control and fresh air duct from the outside wall.

By using this unique system — one of the first of its kind—the architects and engineers were able to produce a building of quality design and construction without increasing initial cost and offering important savings in operating costs.

Write for 16-page illustrated brochure on Marlo "Seazonaire" remote room air conditioning units. Contains photographs and drawings of all models available, construction and performance details, examples of typical installations.

Marlo coil co.

SAINT LOUIS 11, MISSOURI

Quality Air Conditioning and Heat Transfer Equipment Since 1925

Imperialine

EXTRUDED ALUMINUM GRILLES

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Imperialine

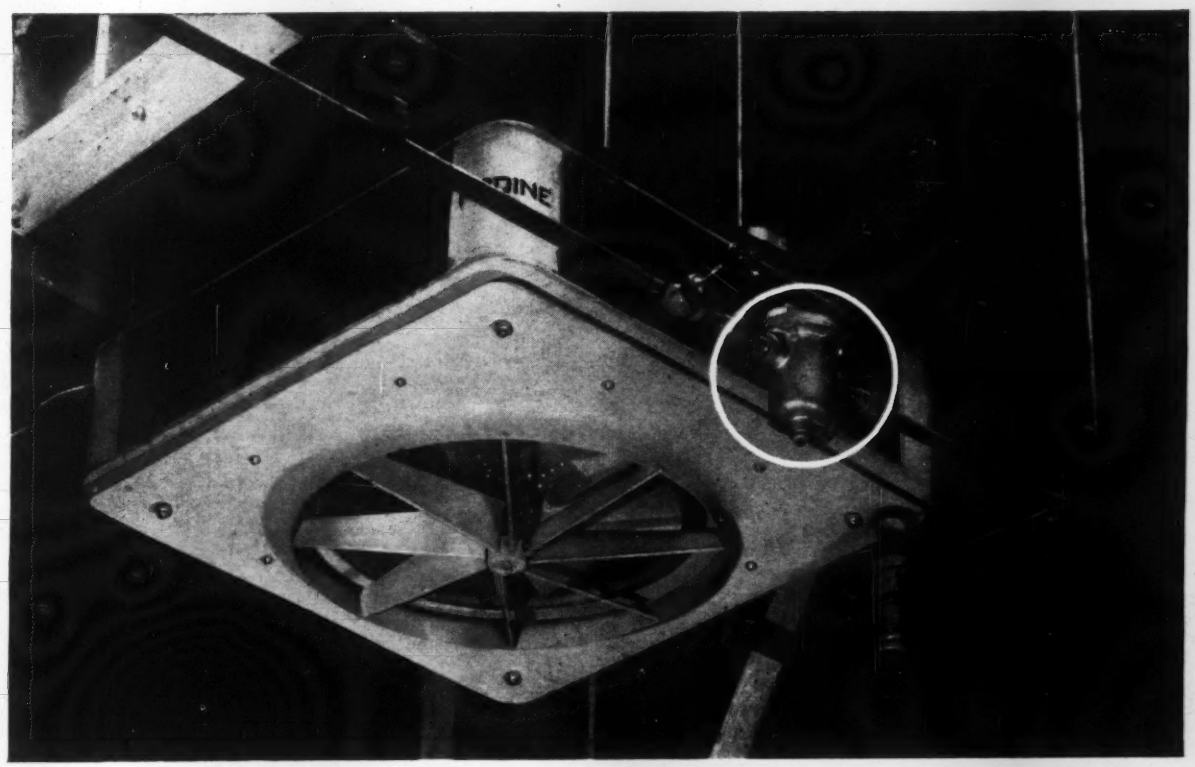
EXTRUDED ALUMINUM GRILLES

Featuring trim, attractive, straight-line styling, Tuttle & Bailey Imperialine EXTRUDED ALUMINUM GRILLES are the answer to architectural demands for air distribution equipment that will harmonize with, or accent, linear design concepts. Universal in application, Imperialine Grilles may be used on the supply or return portions of heating, cooling, or ventilating systems and are ideal for ceiling, sidewall, floor, or sill installation. A Tuttle & Bailey exclusive, the grilles are standard with satin anodized finish. Special finishes and colors are also available.

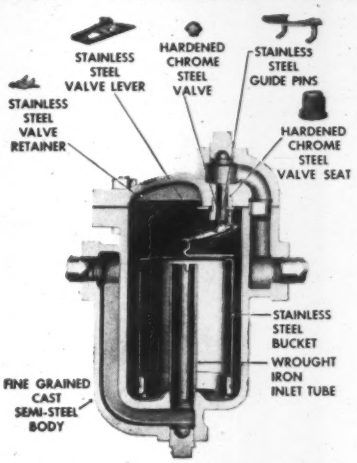
For complete catalog data on Imperialine Extruded Aluminum Grilles, ask your nearest T&B Representative or write direct.

TUTTLE & BAILEY
division of Allied Thermal Corp.
New Britain, Connecticut

TUTTLE & BAILEY PACIFIC, INC. City of Industry, California



How Corrosion of Unit Heaters is Prevented by Good Trapping


STAINLESS STEEL VALVE LEVER
HARDENED CHROME STEEL VALVE
STAINLESS STEEL GUIDE PINS
STAINLESS STEEL VALVE RETAINER
HARDENED CHROME STEEL VALVE SEAT
STAINLESS STEEL BUCKET
WROUGHT IRON INLET TUBE
FINE GRAINED CAST SEMI-STEEL BODY

Good design, good materials mean good trapping with Armstrong Traps for unit heaters.

Cause. Costly corrosion of unit heaters is frequently the result of sluggish condensate drainage and inadequate venting. Any carbon dioxide gas present in the steam supply will go into solution if the condensate is below steam temperature, forming corrosive carbonic acid. Presence of oxygen aggravates the corrosion.

Remedy. Armstrong traps prevent carbonic acid formation because they discharge condensate *at steam temperature* and vent CO_2 and air at the same time. There is never any accumulation of condensate and incondensible gases to cause trouble as can occur with traps that must wait for condensate to cool before they will open.

Trap Selection. It is important that the traps be correctly sized, with a generous safety factor to provide adequate air handling capacity. Armstrong sizing recommedations are thoroughly reliable, being based on actual performance of the traps under operating conditions rather than on theoretical considerations.

Complete Details. Ask for Armstrong Bulletin No. 252 which tells how to select and install traps for any type of unit heater. For your free copy, call your local Armstrong Factory Representative, or write direct.

860 Series for low pressure heating service.

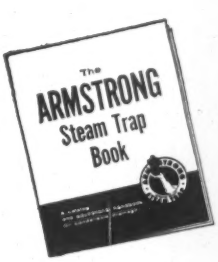
800 Series, side inlet, side outlet.

No. 801, side inlet, bottom outlet.

880 Series, integral strainer.

200 Series, bottom inlet, top outlet.

Forged Steel Series for high pressures, high temperatures.



The 48 page Armstrong Steam Trap Book tells how to correctly size, install and maintain steam traps for any pressure, any temperature, any load plus full catalog data on Armstrong Steam Traps. Ask for Catalog K.

ARMSTRONG MACHINE WORKS

8743 Maple Street Three Rivers, Michigan

"See Our Catalog in Sweets Industrial Construction File"

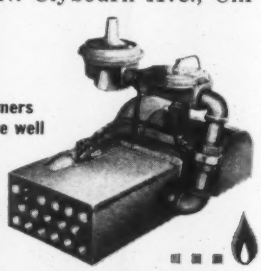
Why so many Birmingham schools heat with LO-BLAST GAS burners

"With the style of architecture we want here in Birmingham, we find that it's more practical to have small gas-fired boilers in each school building rather than build a central plant and pipe heat to each building," says Mr. Fred J. Kelley, Business Manager of the City Board of Education.

"That's one of the reasons why we specified Lo-Blast Power Gas burners for many of our new schools. These units adapt most easily to the boilers we use. What's more, they have a very good record here in Birmingham for safe, consistent performance plus low-cost installation and operation."

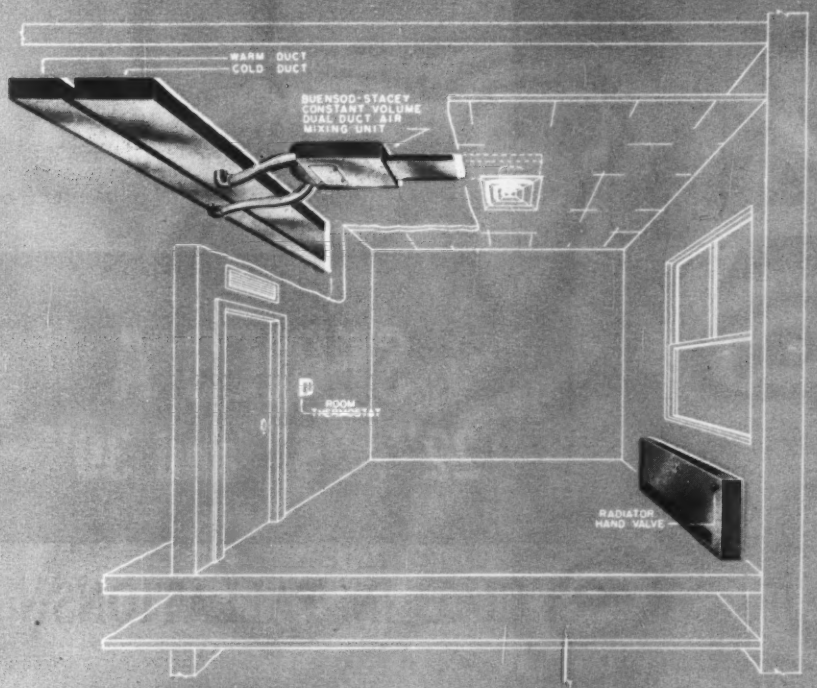
Gas heating can give your schools safe, economical service—especially with the new Lo-Blast burners made by Mid-Continent Metal Products. For complete information, check with your local gas company's Heating Specialist, or write Mid-Continent Metal Products Co., 1960 N. Clybourn Ave., Chicago 14, Illinois.

AMERICAN GAS ASSOCIATION



Economite and Lo-Blast Power Gas Burners operate silently, cost less to install, are well suited for down-draft boilers, and are available in capacities from 70,000 to 20,000,000 BTU.

FOR HEATING ... GAS IS GOOD BUSINESS!



NEW DUAL DUCT SYSTEM WITH OLD RADIATION

DUAL DUCT COMPATIBILITY

Adding air conditioning to an existing building need not be a weighty problem. The radiation system generally inherent to this type of structure can simply and economically be augmented by Buensod Dual Duct. Dual Duct is 100% compatible with existing systems. Zones supplied by the old system are given additive ventilation as required and are cooled in warm weather. Newly created zones are completely conditioned for year-'round comfort.

The Dual Duct system is basically a simple one. Hot and cold air is carried at high velocity in separate ducts. Buensod air mixing units in the various zones quietly deliver just the right amount of conditioned air. And exclusive Automatic Volume Control maintains constant air volume regardless of static pressure variation so the system can never be thrown out of balance. Specify Buensod for your next renovation and see how Dual Duct compatibility simplifies your job.

BUENSOD DUAL DUCT

BUENSOD-STACEY CORP., 45 West 18th Street, New York 11, N. Y.

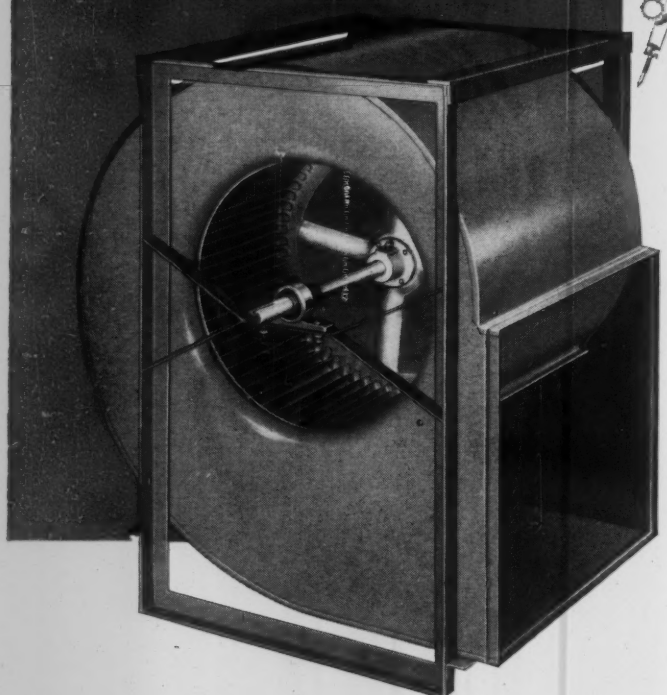
BUENSOD-STACEY

A subsidiary of Aeronca Manufacturing Corporation

LAU

SERIES A
22", 25" and 30"

DESIGNED FOR COMMERCIAL INSTALLATIONS



Built-in flexibility makes the Lau "Series A" the number one choice for commercial and industrial installations. With a C.F.M. range of from 8,000 to 36,000, this efficient unit may be used in many different sizes and types of air conditioning systems. For even greater C.F.M. capacity and flexibility the "Series A" may be operated in banks of two or three.

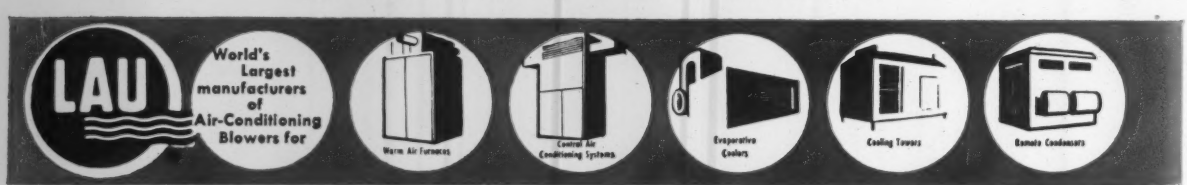
The "Series A" features such quality Lau parts as heavy gauge riveted wheels, large reservoir oil type bearings and sturdy angle framing for housing supports and structural strength. "Series A" blowers provide for either top or rear mounting motor.

Call or write Lau today for more complete and detailed information.

MEMBER INDOOR COMFORT

The Lau Blower Company, 2027 Home Avenue, Dayton 7, Ohio.

Other plants in Kitchener, Ont., Can., and Irwindale, Calif.



For rigid requirements specify *flexible*

Copper Tube

HUSSEY COPPER AND BRASS TUBING & PIPE

•

Copper All Purpose Tube

•

Copper Water Tube (Types K, L, M)

•

Copper Refrigeration Tube (Dehydrated and Sealed Ends)

•

Copper Pipe

•

Brass Tube (also square, rectangular, hexagon)

•

Red Brass Pipe

Of course, copper tube is flexible in the sense that it forms easily. It is flexible, also, in its range of applications because the combination of properties it provides is not found in any other material.

For the finest quality copper tube, always specify Hussey . . . available straight or coiled in sizes, wall thicknesses and tempers to meet your most critical requirements.

Since 1848
HUSSEY
COPPER · BRASS

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

C. G. HUSSEY & COMPANY

Division of Copper Range Co.

Rolling Mills and General Offices
PITTSBURGH 19, PENNSYLVANIA

7 Convenient Warehouses

PITTSBURGH CLEVELAND NEW YORK CHICAGO
ST. LOUIS PHILADELPHIA CINCINNATI

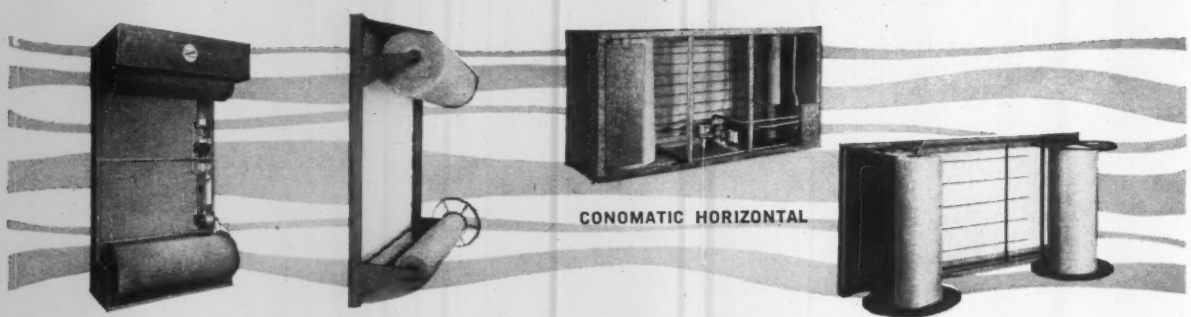
NOW YOU CAN SPECIFY
"UNDERWRITERS LABORATORIES LISTED"
FOR YOUR ROLL-TYPE AIR FILTERS!

CONOMATIC & CONOMANUAL AIR FILTERS

LISTED UNDER REEXAMINATION SERVICE UL UNDERWRITERS' LABORATORIES, INC. OF

For safety's sake, specify "Underwriters Laboratories listed". Both CONOMATIC and CONOMANUAL, horizontal and vertical models equipped with DYCON media, now bear two important marks of confidence . . . the UL seal and the Continental label.

THESE ARE THE ONLY ROLL TYPE FILTERS LISTED BY UNDERWRITERS LABORATORIES



VERTICAL CONOMATIC VERTICAL CONOMANUAL CONOMATIC HORIZONTAL CONOMANUAL HORIZONTAL

CONOMATIC, the automatic roll-away air filter is compact, dependable, easy to maintain. It simplifies design problems, saves on installation costs—CONOMATIC arrives on the job site fully assembled and completely wired—**in conduit**—ready to be put into position. Make the power supply connection and the CONOMATIC is ready for operation!

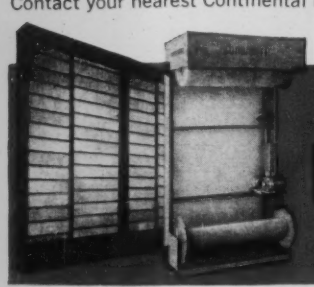
Request Bulletins No. 819, No. 822.

CONOMANUAL, sized to fit almost any need, puts work-saving, worry-saving conveniences within reach of even the very small budget.

Request Bulletin No. 850

Contact your nearest Continental representative, or write

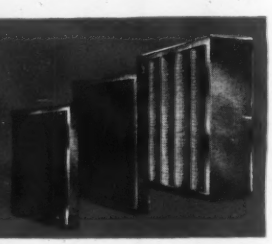
Engineers, Contractors, and Owners are happier when Continental Clears the Air



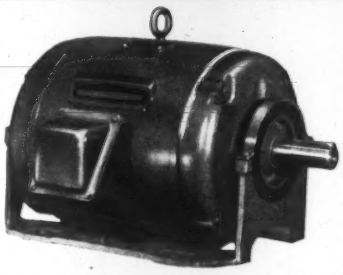
AIR CONTINENTAL FILTERS

P. O. BOX 1647 LOUISVILLE 1, KY.

CONTINENTAL AIR FILTERS Inc.



In Old New Orleans...



Wagner Resilient Mounted Polyphase Motors are available in ratings from 1 through 10 hp with sleeve or ball bearings.

Wagner *"Extra-Quiet"* Motors Help Cool

A NEW "CABILDO"

Been to New Orleans lately? The French Quarter . . . with its Bourbon Street and laced grillwork, gourmet dining and the Cabildo, New Orleans' first city hall . . . is still there. An island of old-world charm in a progressive city.

Progressive for sure, as exemplified by another "Cabildo". . . modern New Orleans' new City Hall. Show place? Yes, but first and foremost, a place of work . . . a functional house of municipal government. A gleaming glass and concrete exterior suggests this functionalism. Interior space arrangement confirms it. Complete air conditioning clinches it, comfortably.

Wagner "extra-quiet" motors play a vital part in providing this comfort. Eighteen Wagner resilient-mounted polyphase motors operate the fans used in the Marlo floor-type central station air conditioning units to circulate clean, cool air. For this type application—where noise must be kept to a minimum—they are ideal. Cushioned by their resilient mounting, they start smoothly and easily, and run with barely a whisper of sound. They do their job well in New Orleans. Anywhere, actually.

Whatever your motor requirements, Wagner can supply a standard motor or build a special motor to fit your needs. More than 65 years of constant research and development in electric motor design have made Wagner a name you can depend on. Call your nearby Wagner Sales Engineer for an analysis of your next motor application, be it for plant or product. There are Wagner Branches in 32 principal cities.

BRANCHES AND DISTRIBUTORS IN ALL PRINCIPAL CITIES

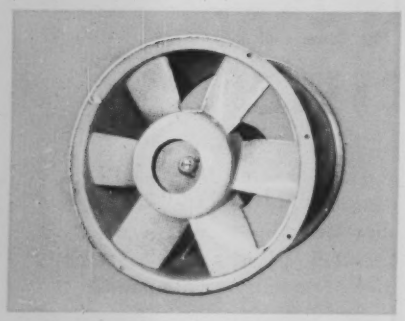
WM60-10

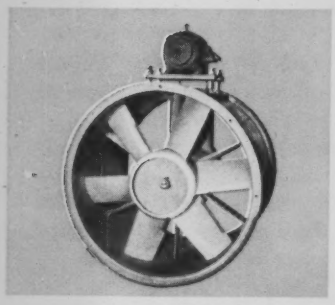
Wagner Electric Corporation

6370 Plymouth Ave., St. Louis 33, Missouri.

SERVING 2 GREAT GROWTH INDUSTRIES— *ELECTRICAL • AUTOMOTIVE*

New Features at Lower Cost Offered by New Designs of Wing Roof Ventilators and Fan Equipment





Three new distinctively designed roof ventilators offer Wing's famous sturdy construction plus many new features at lower prices. Some of the unique features of these new models are nylon damper bearings, rubber and magnetic snubbing of dampers for weathertight closing and flutter elimination, and hinged windguards.

Now you, too, can benefit from the experience Wing has gained over many years as a builder of fan equipment to the exacting requirements of maritime and military specifications. The new Wing vaneaxial and tubeaxial direct and belt-driven models provide top quality and distinctive design features at lower prices than before.

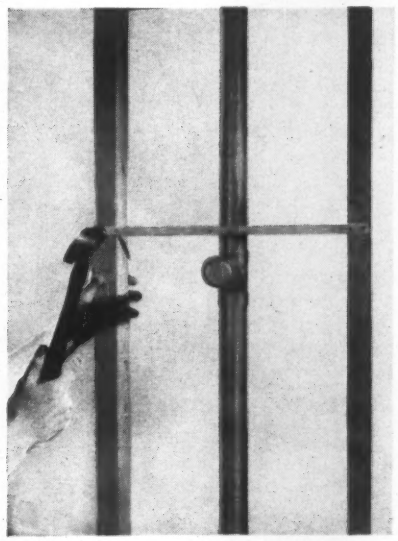
Write today for information on this new equipment and how it can solve your summer ventilating problems.

WC151

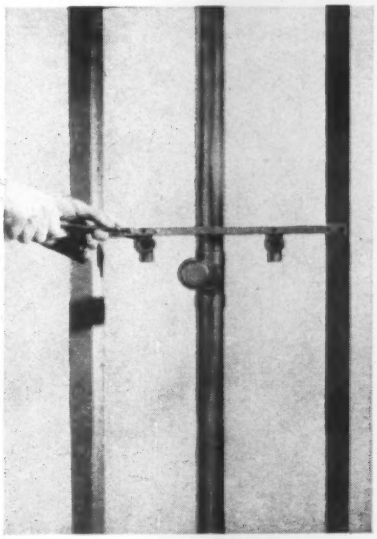
WING

L. J. WING MFG. CO.
DIVISION OF AERO SUPPLY MFG. CO. INC.
140 VREELAND MILLS ROAD, LINDEN, NEW JERSEY
FACTORIES: LINDEN, N. J. AND MONTREAL, CANADA
IN EUROPE: WANSON, HAEN-NORD, BRUSSELS, BELGIUM

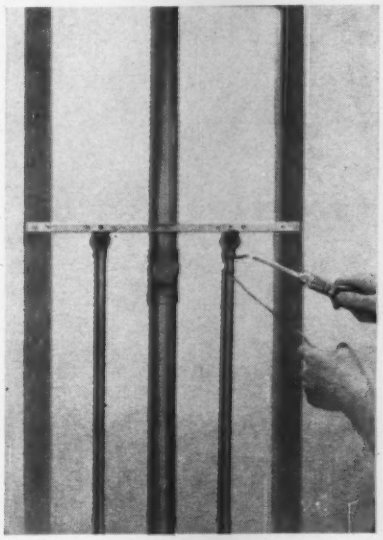
NEW ANACONDA COST-CUTTING KITS—to help you rough in hot and cold water lines FASTER, EASIER, BETTER



1. Nail strap to studs—no blocking, no sawing, no notching to avoid vents.



2. Fasten fittings to the perforated strap with self-tapping screws.



3. Solder the fittings to the risers—and the installation is complete.

Kits for every need

90° ELLS

1707-3-5A	Copper to F.S.P.S.	3/8"
1707-3-5A	Copper to F.S.P.S.	1/2"
1707-3-5A	Copper to F.S.P.S.	1/2" x 3/8"
1707-5A	Copper to Copper	1/2"

TEES

1711-5A	Copper to Copper to Copper	1/2"
1712-5A	Copper to Copper to F.S.P.S.	1/2" x 1/2" x 3/8"
1712-5A	Copper to Copper to F.S.P.S.	1/2"

THRU-WALL ADAPTER

1703-5A	Copper to F.S.P.S.	1/2"

Convenient—Reasonably Priced

EACH ANACONDA QUIK-RUF KIT CONTAINS: 10 Anaconda High Ear Fittings, 6 Stud Straps, 20 Self-Tapping Screws, and 12 Nails.

These new Anaconda Quik-Ruf Kits are sold by distributors of Anaconda Copper Tube and Fittings. The prices are right. So get a stock of kits now and start saving time and money right away.

6002

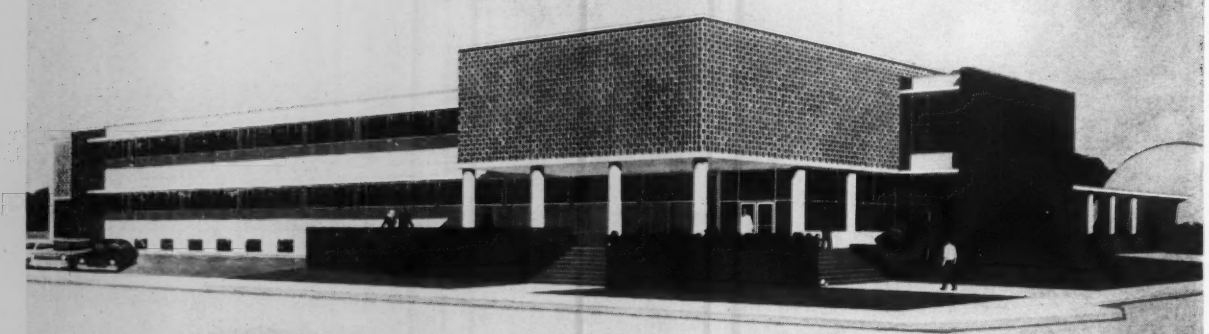
ANACONDA®

MADE IN U.S.A. TO THE STANDARDS OF AMERICAN INDUSTRY

COPPER TUBE AND FITTINGS

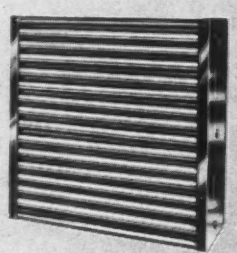
Products of The American Brass Company

in the Chemistry-Geology Building,
San Antonio College, San Antonio, Texas



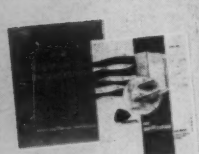
Phelps & Dewees & Simmons, Architects
Gerard M. Baker, Consulting Engineer
Jud Plumbing & Heating Co., Inc., Contractors

STALE AIR is RECOVERED, RENEWED, READIED for economic RE-USE by DOREX



#52C CELL

Permanent economy in air conditioning system operation is a key concern of architects and engineers alike in their conception and design of modern buildings.
. . . which is precisely why Dorex Air Recovery equipment is a vital part of the air conditioning systems of so many new structures, large and small. It has been proved that air conditioning costs can be cut by 78% annually if a system uses Dorex to recover stale, already conditioned air rather than use 100% outside air.
Here in the new Chemistry-Geology building, San Antonio College, thirty activated carbon Dorex #52 C Cells, designed into the supply air system in the building's fan room, recover the fume-laden, already used air, convert it to original freshness, and bring about maximum economy in the air conditioning process. The thirty cells have a combined air handling capacity of 30,425 cfm.

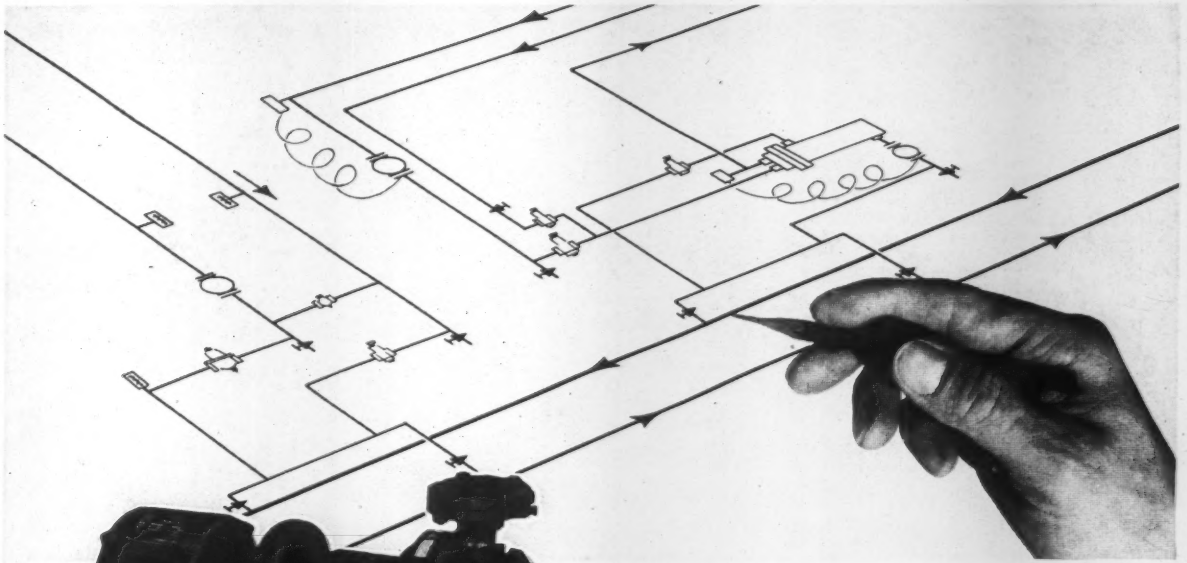


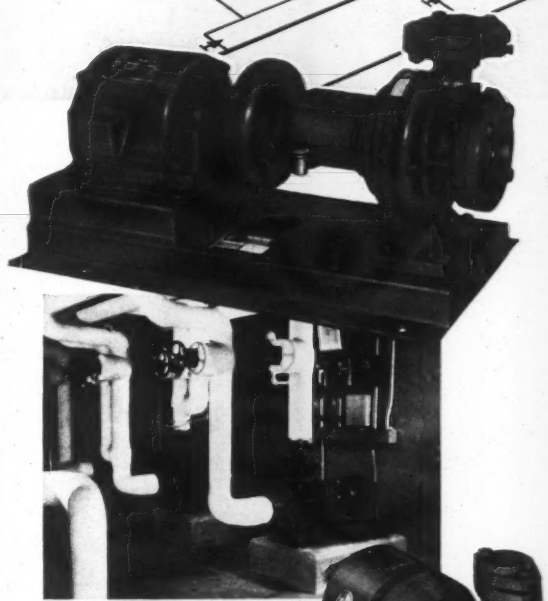
For more information, request—on your letterhead, please—copies of Bulletin 108A and the textbook, "Air Conservation Engineering" Contact the representative near you or write to Connor direct.

CONNOR ENGINEERING CORPORATION
DANBURY • CONNECTICUT

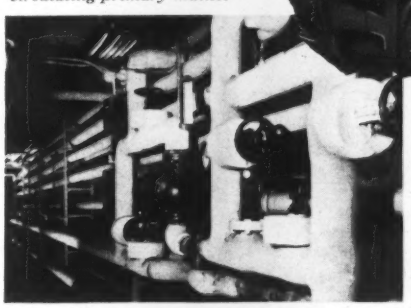
CONNOR ENGINEERING CORPORATION
dorex® air recovery

. . . the most experienced professionals in air recovery and purification.





B&G Universal Pumps circulating primary mains.



B&G Booster Pumps supplying individual heating zones.

Primary and secondary pumping as developed by B&G® cuts heating system operating costs

Where multiple buildings or multiple zones within a building are to be heated with circulated water, *Primary and Secondary Pumping*, as conceived and developed by Bell & Gossett engineers, both reduces pump horsepower and saves fuel by improving heat control.

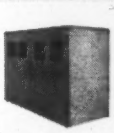
A typical system consists of a primary main continuously circulated by a B&G Universal Pump, with smaller B&G Booster Pumps drawing on the main to supply separate heating zones. Each zone pump is under individual thermostat control, so that each zone can be supplied with exactly the amount of heat required by its function or exposure.

Write for free booklet which gives detailed information on this more efficient, more economical method of heating with circulated water.

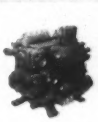
BELL & GOSSETT
COMPANY
Dept. GH-5, Morton Grove, Illinois
Canadian Licensee: S. A. Armstrong, Ltd., 1400 O'Connor Drive, Toronto 16, Ontario

A DIVERSIFIED LINE OF HIGHEST QUALITY PRODUCTS

Booster Pumps



Package Liquid Coolers

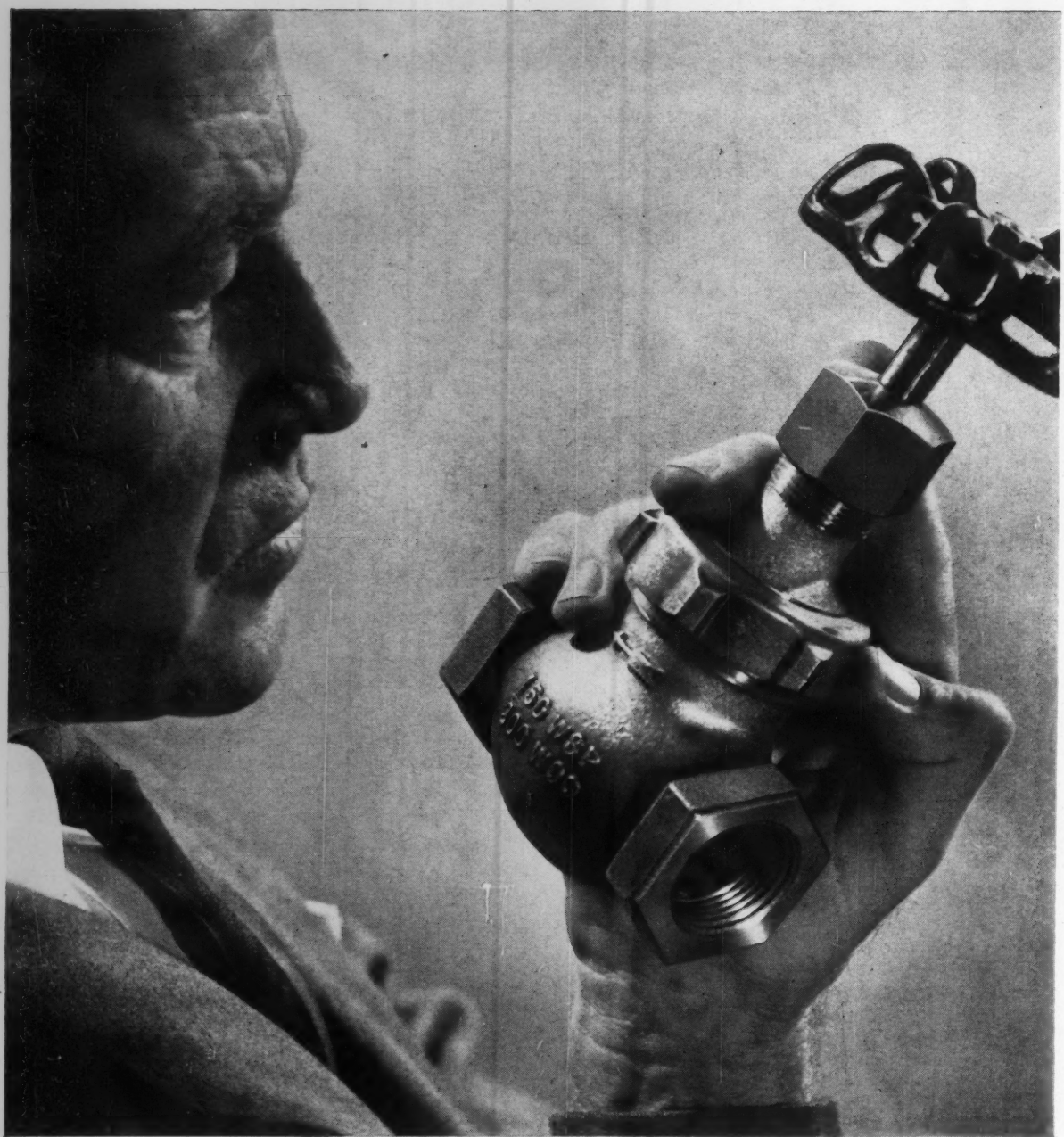


Refrigeration Compressors

Marlow Pumps

Heat Exchangers

Oil-less Air Compressors



MEN WHO BUY VALVES for heavy-duty service quickly see the plus values in O-B plug type valves. Union ring reinforces centerpiece joint—stainless steel seat and plug are O-B-500-hardened—plug is self-leveling. Really rugged globe and angle valves that lick your toughest problems! Ask your distributor for the valve in the orange-and-black box.

OHIO BRASS COMPANY • Mansfield, Ohio

O-B VALVES

HOLAN

10075-V

Protect profits from call-back expense . . . insulate hot and cold water lines with

Presst-O-Cel:®

the lightweight, flexible, closed cell insulation

PRESST-O-CEL not only insulates equal to or better than glass fibre, wool, cellular rubber, corkboard, rigid plastics and others . . . *it has built-in protection for itself!*

- Internal oxidation and deterioration are prevented by millions of inert gas cells.
- Will not get brittle from prolonged heat exposure.
- Use on hot lines to 220° F., cold lines to −40° F.
- Non-inflammable, will not conduct flame.
- Install below grade—fungus and vermin resistant, impervious to moisture, will not rot.
- Use on weather-exposed lines with simple external treatment.
- Flexible, lightweight, fast and easy to install.

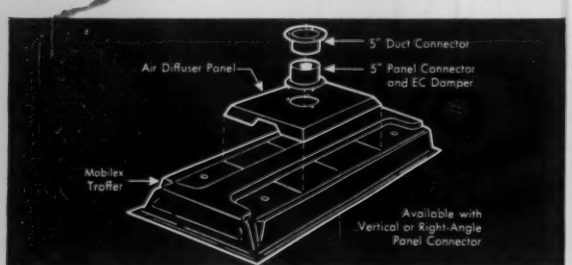
WRITE TODAY for sample and data. Address Dept. B-22.

PRESSTITE DIVISION
AMERICAN-MARIETTA COMPANY

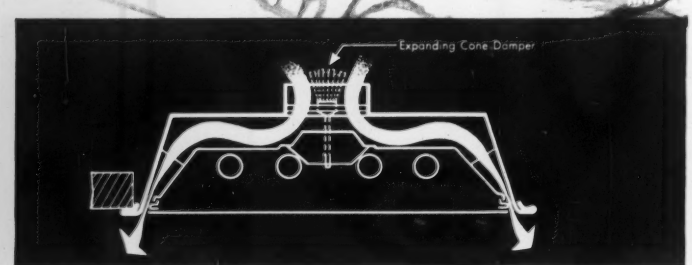
3792 CHOUTEAU AVE • ST. LOUIS 10, MO.

6090

New concept in Air -

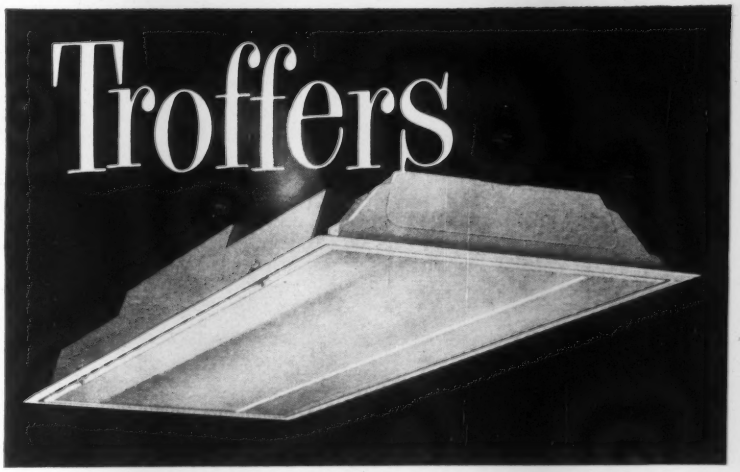

5" Duct Connector
Air Diffuser Panel
5" Panel Connector and EC Damper
Mobilex Troffer
Available with Vertical or Right-Angle Panel Connector

Units are easily installed, easily adjusted, and easily serviced.



Air is completely isolated from the light by double-wall construction—a patented Barber-Colman feature.

Diffusing Troffers



Patented* double-wall construction isolates air from light for

- Controlled air distribution
- Freedom from smudging
- Maximum lighting efficiency

*Patent No. 2564334, others pending.

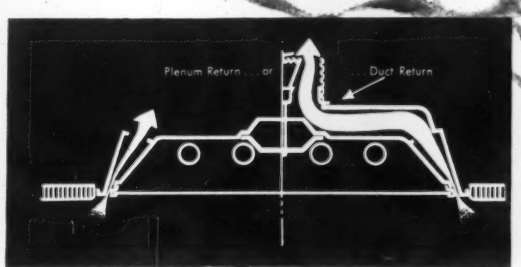
These units are the combined development of two leaders in their respective fields — Barber-Colman in engineered distribution of air and Day-Brite in engineered distribution of light. They ideally unite these two factors in a distinctive modular unit to provide the ultimate in human comfort and flexibility in interior design.

Air passes through a separate chamber completely isolated from the fluorescent tubes and is diffused into the room at low noise levels. Thorough aspiration at moderate velocities completely eliminates drafts.

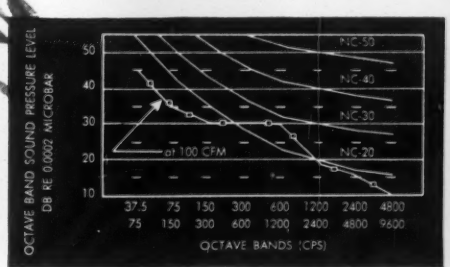
Physical separation of light and air eliminates smudging of the fluorescent tubes, reflector, and ceiling. There is no reduction in luminous area. Lighting output is maintained at uniform high efficiency because the fluorescent tube temperatures are maintained at optimum level, unaffected by air temperature and flow.

Combination diffusers may be used to handle either supply or return air and are available in 1 x 4 and 2 x 4 sizes with either two or four fluorescent tubes in a variety of glass, plastic, or metal enclosures.

Call Barber-Colman or Day-Brite for complete specifications — ask for new Catalog F-9768.



Combination units may be used for either supply or return air service.



Low noise assured – octave band sound data and NC ratings available.

BARBER COLMAN

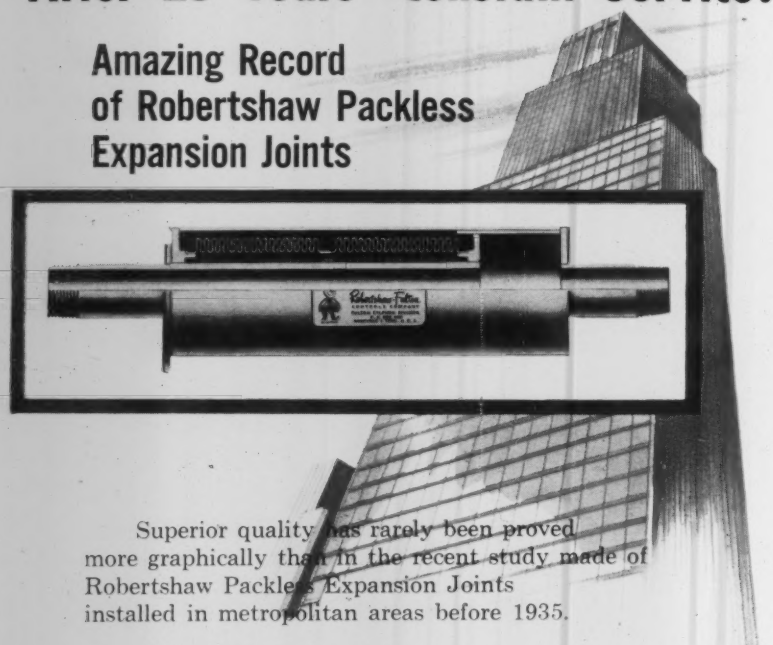
BARBER-COLMAN COMPANY

Dept. H, 1301 Rock Street, Rockford, Illinois

Uni-Flo engineered air distribution products and Electronic automatic controls

Less than 1% Annual Replacement After 25 Years' Constant Service!

Amazing Record of Robertshaw Packless Expansion Joints



Superior quality has rarely been proved more graphically than in the recent study made of Robertshaw Packless Expansion Joints installed in metropolitan areas before 1935.

Even after 25 years of constant day-in and day-out service under all conditions, a random sampling of 50,000 installations showed that *annual replacement even now runs less than 1%!*

Yes, quality is the answer—a quality never sacrificed for the quick dollar or to meet temporary price competition.

When you specify Robertshaw Packless Expansion joints—for vertical risers or horizontal runs—that same quality still protects you—on through the years, where protection counts most.

Each leakproof, lifetime joint is built around a Robertshaw Sylphon® "living metal" bellows designed for that specific application . . . designed and made by the company that knows more about bellows than anyone else in the world—and have for over 50 years.

There's a lot more about Robertshaw Packless Joints in our Bulletin PH-65. Ask for it.

Robertshaw

MR. CONTROLS

Robertshaw-Fulton Controls Co.

FULTON SYLPHON DIVISION, KNOXVILLE 1, TENNESSEE

"Who makes it?"

"Where can we get it?"

FOR THEIR ANSWERS

- Consulting Engineers
- Engineers In Industrial Plants
- Engineers In Large Buildings

And

- Mechanical Contractors

will go to the

Heating, Piping & Air Conditioning

January 1961 Issue

which will contain our Directory Section

START MAKING YOUR PLANS NOW FOR ADEQUATE SPACE

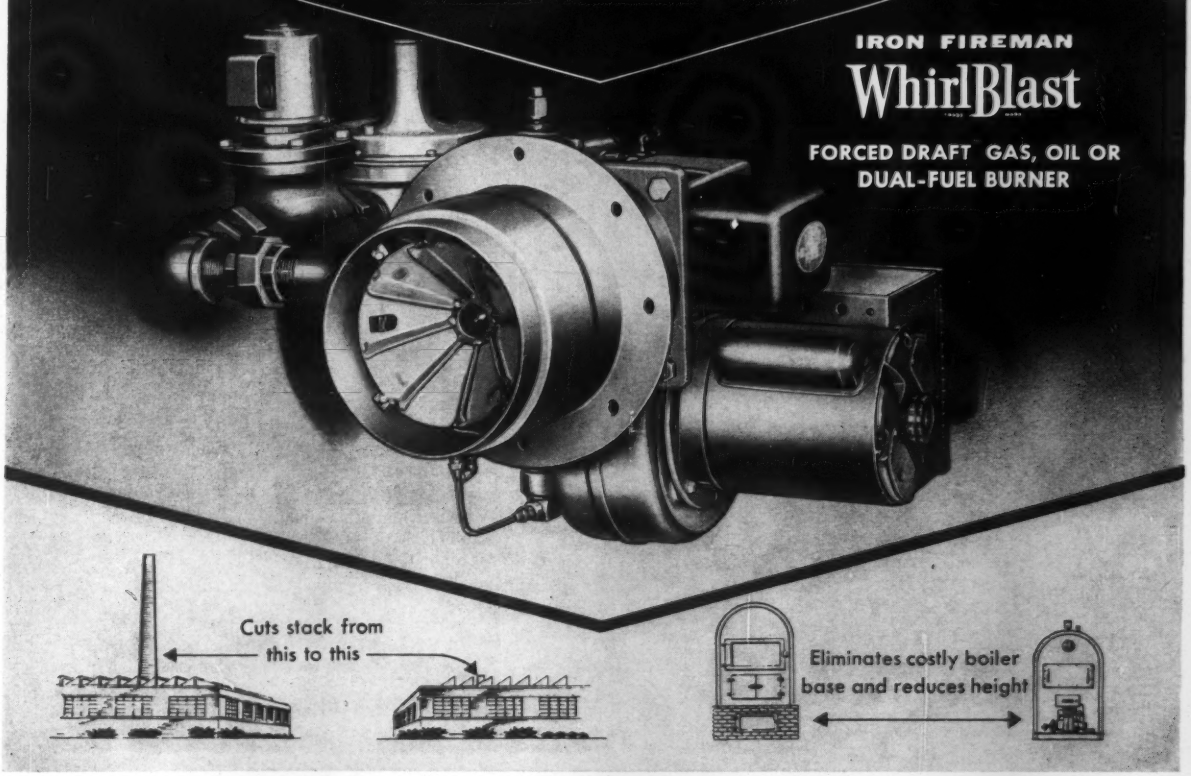
The new world of

HEATING

IRON FIREMAN

WhirlBlast

FORCED DRAFT GAS, OIL OR DUAL-FUEL BURNER



SAVES CONSTRUCTION COSTS

No stack — no pit — no brick, inside or out. In a sealed firebox only a smoke vent is required. No high stack, no bulky draft inducer, no secondary air dampers or ducts, no brick setting, no boiler refractory. Burner fits any boiler; it simply bolts to the boiler front, with firing head through the fire door opening.

NO FLAME PULSATION

Steadiest flame ever developed. The WhirlBlast firing head, a new design, solves the persistent problem of flame pulsation. A steady, efficient, fuel-saving flame is achieved without firebox breather vents or any other makeshift device. Fires gas or oil with high efficiency; changes fuels instantly.

CLEAN

No smoke; burns clean. Accepted standards of oil firing allow a 15 minute warm-up period, during which time smoke is tolerated. The Iron Fireman WhirlBlast burner produces a clean flame in seconds, preventing fuel waste, fouled flues and air pollution.

PACKAGED

No special skill to install, adjust, service or operate When you bolt the WhirlBlast unit to the boiler front you install a complete forced draft firing system, combining air and fuel systems and electronic combustion controls. It leaves the factory as an operating unit, factory wired and tested.

Send coupon for further information

IRON FIREMAN

HEATING AND AIR CONDITIONING
AIRCRAFT COMPONENTS AND EQUIPMENT
MISSILE AND AIRCRAFT GYROSCOPES
ELECTRONIC EQUIPMENT
CONTROL INSTRUMENTS

Iron Fireman Mfg. Co., 3099 W. 106th St., Cleveland 11, Ohio.
(In Canada, 80 Ward St., Toronto)

Please send full information and specifications on the WhirlBlast Burner.

Name _____

Firm _____

Address _____

City _____ State or Prov. _____

where a graceful silhouette makes a big difference

Circular Air-Cooled Condenser design blends with modern building needs

The new Fandaire offers more than architectural compatibility. It combines modern low silhouette lines with an exclusive high-heat dissipating fintube design. Unique in its efficiency, the entire circular spiral of fintubing is flooded with swiftly moving air from every direction, utilizing fully each degree of temperature drop.

Because the Fandaire weighs ⅓ less than conventional installations, it can be positioned where needed, without guy wires or extra bracing. *Savings in piping and installation alone can be considerable.* Fandaire is engineered in sizes from 3 to 120 tons – a model for practically all single or multiple installations. In terms of performance, these are the most economical air-cooled condensers available today. Easy to look at, too. Ask for complete information.

SET IT ANYWHERE. IT'S ALWAYS FACED RIGHT...REGARDLESS OF WIND DIRECTION

Fandaire's circular design captures the wind from any direction, regardless of placement or location. Powerful fan pulls cool air in—pushes warm used air up and away.

specialists in circular air-cooled condensers

YUBA-AIMCO DIVISION
801 West 21st Street, Tulsa, Oklahoma

YUBA CONSOLIDATED INDUSTRIES, INC.

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THE NEW, TIGHT-CLOSING PRESSURE REDUCING VALVE THAT *CAN'T FOUL*

If you like a simple, straight-forward solution to vexing valve problems, you're bound to be impressed with the new line of Leslie-Topper Pressure Reducing Valves. To avoid valve fouling, Leslie Engineers developed a tight-closing valve with an internal pilot that's completely out of the path of steam—*it just can't foul.* Let imaginative engineering simplify valve design and you get results.

Here's the one pressure reducing valve that handles poor steam conditions, intermittent or standby service better than any other valve. It provides high accuracy of regulation with negligible dead-end build up and costs only pennies for maintenance.

New, patented Leslie-Spiroflex* all metal diaphragm insures years of outstanding valve performance. It makes a long valve stroke possible in a packless design—there's nothing to leak, nothing to bind. It's time for a change when you can get rid of the cost and bother of fussy, old-fashioned pressure regulators.

*Trademark of Leslie Co.

Leslie-Topper Selection Table

Size	Inlet Pressure PSI	Adjustable Pressure Range PSI	CLASS		
			Cast Iron Construction	Bronze Body Construction With Iron Superstructure Castings*	All Bronze Construction
½" TO 1¼"	UP TO 150	2 - 10	GKLL	GLL	GBLL
	OVER 125	2 - 10	GKL	GL	GBL
	UP TO MAXIMUM BODY RATING	5 - 20	GKM	GM	GBM
		15 - 35	GKH	GH	GBH
1½" TO 2"		2 - 10	GKL	GL	GBL
		5 - 20	GKM	GM	GBM
	UP TO 150	5 - 35	GKHL	GHL	GBHL

*All parts in contact with controlled fluid are of bronze.

For sizing and capacity data write for Bulletin 582 or contact your Leslie Engineer—he's listed in the Yellow Pages under 'Valves' or 'Regulators'.

Leslie Co., 703C Grant Ave., Lyndhurst, New Jersey

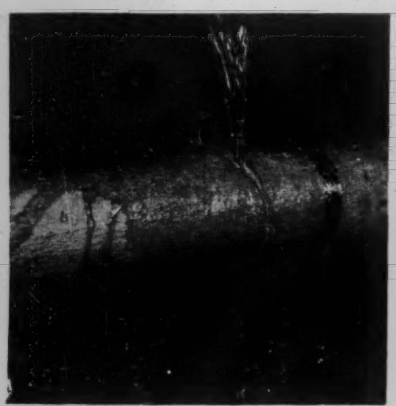
This new Leslie-Topper Pressure Reducing valve is a part of Leslie's expanding line of control valves, regulators and pilots for steam, air and liquids.

TRADE LESLIE MARK

REGULATORS and CONTROLLERS

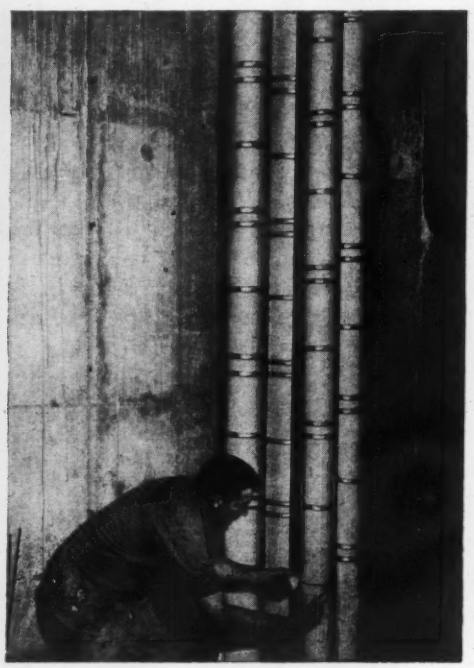
New **FOAMGLAS®** STAY-DRY

Five important benefits for all



Constant insulating value. North Brothers Contractors, Atlanta, Ga., found an excellent way to prevent insulation "fade" on building service piping at Colbert County Hospital, Sheffield, Ala. The low-cost solution was FOAMGLAS STAY-DRY Pipe Insulation. The closed glass cell composition of FOAMGLAS makes it completely impervious to water and atmospheric moisture—even in this highly humid climate. Thus, it never loses its insulation value, assures constant thermal efficiency for the life of the building.

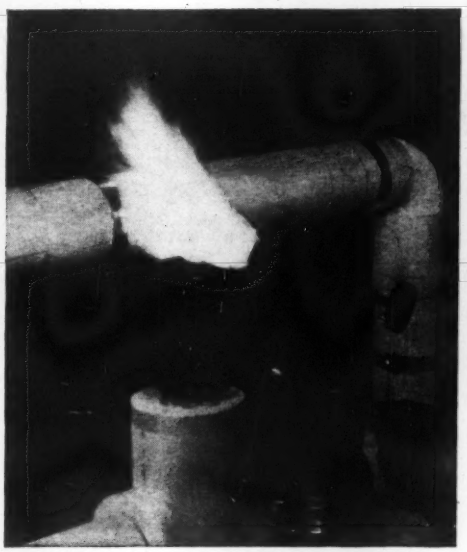
Installed and finished in one operation. There is no priming of the pipes at the beginning of the job. Just apply the 24-inch sections of FOAMGLAS, seal the longitudinal flap of the jacket with PC's Pittseal 222 and apply a 3″ butt strip. Band at the butt joints and center of the segment. No separate vapor barrier or vapor seals are necessary since FOAMGLAS is its own vapor barrier. Sections are easy to cut and shape to accommodate any pipe run irregularities. One easy operation with one material from one supplier.



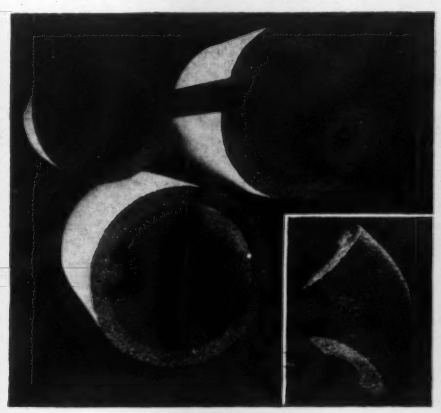
No weak spots . . . no slump or sag. Its high compressive strength lets FOAMGLAS support its own weight. There is no slumping or sagging of the insulation, regardless of how high the vertical piping runs may be. That same strength permits pipe hangers to support the insulation without danger of compression or puncture. This prevents thermal short circuits and eliminates the expense of wrapping hangers in felt. Since FOAMGLAS eliminates condensation, hangers will never rust out.

PITTSBURGH

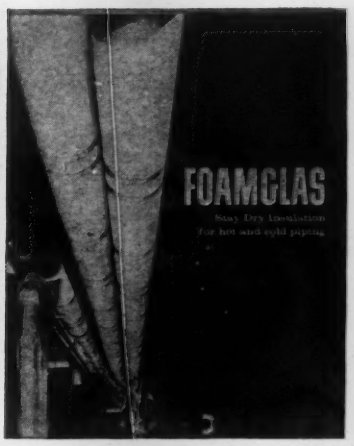
Pipe Insulation...
building service lines



No fire hazard. FOAMGLAS is inorganic so it cannot burn—even when subjected to the extreme test illustrated here. To insure this complete incombustibility, even the Kraft-laminate jacket is *self-extinguishing*, and no additional fire-proofing treatments are necessary. Many insulations act as a wick in cases of fire, but FOAMGLAS is the only completely fireproof insulation available to commercial builders today—and at no additional cost.



Complete range of sizes and fittings. Now complete piping systems can have all the benefits of FOAMGLAS STAY-DRY Pipe Insulation, for temperatures ranging from +35° to +350°F. Available in 1″ and 1½″ thicknesses for all lines from ½″ copper tubing to 12″ I.P.S. Sizes through 6″ I.P.S. are shipped in 24″ lengths; 8″, 10″, and 12″ I.P.S. in 18″ lengths. Fitting covers and elbows can be furnished for all fittings used in piping systems up to 12″ I.P.S. This full range of sizes makes FOAMGLAS suitable for ice water lines, chilled water lines, low pressure steam lines, hot water and dual temperature lines as well as larger underground piping. Standard FOAMGLAS is ideal for tanks and allied equipment in building service systems.



Write for new catalog. For detailed information, write for our new FOAMGLAS STAY-DRY Pipe Insulation Catalog, FI-108. Just address your request to: Pittsburgh Corning Corporation, Department HP-80, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Que.

PC CORNING

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"FASTEN ONTO SOMETHING GOOD"

(OR TO DRILL IT OR CUT IT)

KNOW THE MAN WHO CAN SHOW YOU HOW

Specifically, for multiple fastening in building and construction with metals of all kinds . . . and for fastening to, drilling or cutting concrete, it pays to know the man from OMARK.

He not only offers you a variety of systems for doing such work. He also brings you experienced on-the-job counsel, and an engineering service to help you specify exactly the right equipment for doing the job, rapidly, dependably and economically.

Join the increasing number of engineers, designers and contractors who are finding that, in the fields of metal fastening, and concrete fastening, drilling and cutting, the man from OMARK is "the man who can show you how." Phone him at your nearest OMARK direct factory branch.

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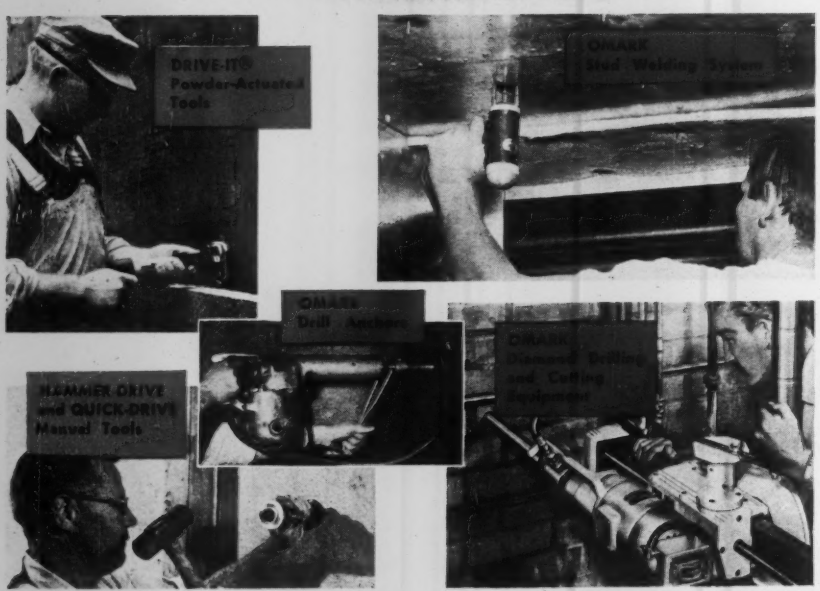
Fastening, Drilling and Cutting Equipment For Building and Industry



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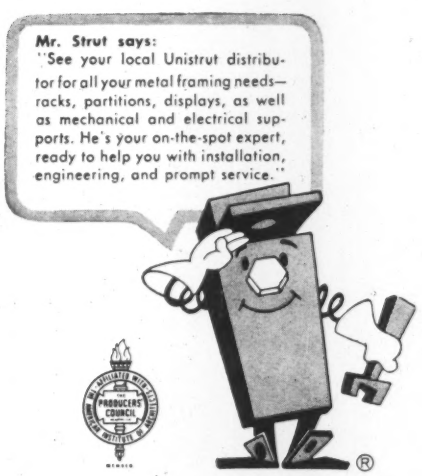
Call your Unistrut distributor for

FAST LOCAL SERVICE

on the world's most complete line of mechanical and electrical supports


Mr. Strut says:
"See your local Unistrut distributor for all your metal framing needs—racks, partitions, displays, as well as mechanical and electrical supports. He's your on-the-spot expert, ready to help you with installation, engineering, and prompt service."
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With the UNISTRUT system of mechanical and electrical supports you're never out on a limb for the right fitting. Unistrut engineers, with more years of experience behind them, have developed a line of fittings and accessories that is unmatched for its completeness and versatility. No matter what kind of on-the-job problems you run into, the UNISTRUT system provides matched framing channels and fittings to handle it.

No makeshifts, no costly delays. Your Unistrut distributor maintains complete stocks at all times to give you on-the-spot service. For all your mechanical and electrical supports, stick to UNISTRUT, the original—and still the world's most versatile —adjustable metal framing system.

You can't make a mistake with UNISTRUT framing...it's 100% adjustable on the job. And there's a UNISTRUT fitting for every need. Call or write for catalog.

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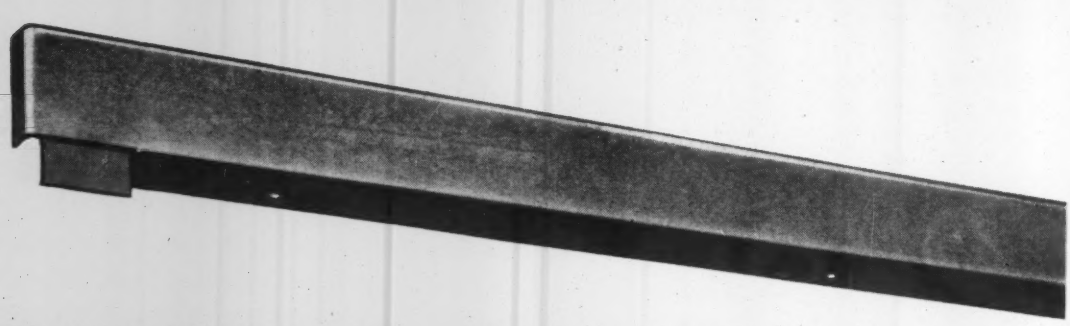
Stocking distributors in all principal cities of the United States and Canada. Exported throughout the world.



PERMA-LAP® FRAMED MODINE CONVECTORS
EASIEST TO INSTALL, EASIEST ON THE WALL

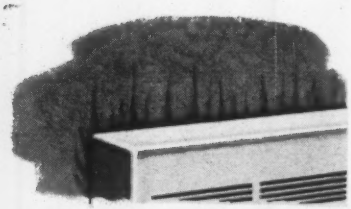
PERMA-LAP framing assures a neat, permanent, recessed installation . . . units can be serviced without disturbing wall seal

Modine's PERMA-LAP framing ends all the problems common to recessed convectors of conventional design. With PERMA-LAP, Modine convectors install fast and clean . . . whether walls are smooth or rough. PERMA-LAP neatly frames the unit in the recess . . . snugs up to finished walls or can be plastered in. No chance for air leakage and resulting wall streaking.

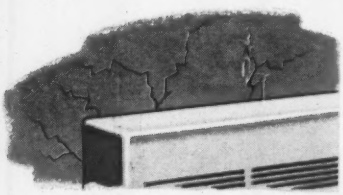
Once Modine convectors are installed, walls are never disturbed. Servicing? Nothing to it! Machine screws permit rapid removal and replacement of the lighter-weight, smaller front panel . . . eliminate need for access doors.

Cost more? Yes, slightly more than conventional recessed convectors. But they actually save more than the difference in lower installation and redecorating costs.

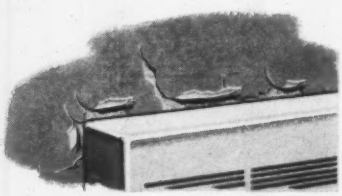
PERMA-LAP is available for flush recessing and in 2⅜", 4⅜" and 6⅜" projections to permit partial recessing of convectors in walls of varying thicknesses. Modine's line of recessed cabinet units is also available with PERMA-LAP framing. For complete details, mail the coupon below. Or contact your Modine representative . . . he's listed in the yellow pages.



NO WALL STREAKING!



NO CRACKED PLASTER!

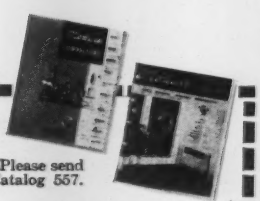


NO PEELED WALLPAPER!

NO "STARRED" CORNERS!

Modine®
MANUFACTURING COMPANY

In Canada: Sarco Canada, Ltd., Toronto 8, Ontario



MODINE MANUFACTURING COMPANY
1509 DeKoven Ave., Racine, Wisconsin
I would like complete PERMA-LAP details. Please send Convector Bulletin 259 and Cabinet Unit Catalog 557.

NAME.....

FIRM.....

ADDRESS.....

.....

R-1413

Mr. Paul E. Grunau, center, talking over an installation problem with Mr. Morton R. Spence, left, of Rundle-Spence, National Tube Distributor, and Mr. Leslie Smith, National Tube's representative in Milwaukee. This type of round-table discussion indicates the close relationship between contractor, National Tube Distributor and National Tube.

"We had only 14 hours to repair a cooling system and save $100,000 in perishable foods—

our National Tube Distributor helped us finish the job in 12 hours,"

says Mr. Paul E. Grunau, Secretary-Treasurer, Paul J. Grunau Company, Mechanical Contractors, Milwaukee, Wisconsin

"We got this emergency job late at night," says Mr. Grunau. "Yet, our National Tube Distributor, the Rundle-Spence Company, gave us immediate service. But our National Tube Distributor is always ready for critical situations. He keeps two trucks on a stand-by basis, and there's a four-man crew on 15-minute call seven days a week.

"Rundle-Spence offers expert engineering and technical advice, constantly feeds us new product information, and is a single, complete source of steel tubular products. We also know that our National Tube Distributor has a wide range of available pipe sizes—⅛-inch to 24-inches. We've standardized on National Tube products for all piping installations, because they're the finest tubular products in the world."

Why don't you combine the fast, dependable service and technical assistance of a National Tube Distributor with USS National Steel Pipe? The next time you need top-quality steel pipe for plumbing, heating, power or air-conditioning applications, see your local National Tube Distributor.

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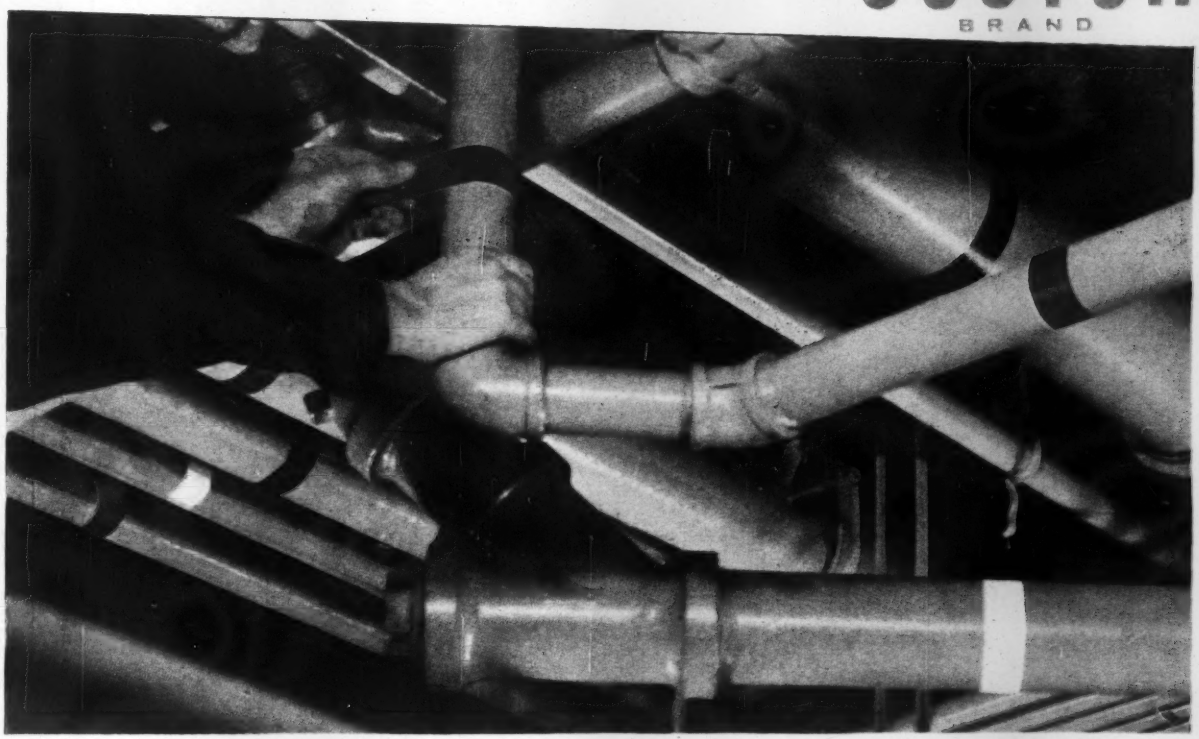
National Tube Division of United States Steel

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York

SCOTCH
BRAND



TAPEnology... industry's newest cost-cutting tool

TAPE COLOR-CODES PIPELINES FOR EASY TRACING OR SERVICING

See how easily colored "Scotch" Brand Plastic Tape provides at-a-glance identification for pipe and duct systems. Colored bands roll on dry—stick at a touch to any clean, dry surface. Tape is easy to apply even in cramped hard-to-reach areas.

Color coding with "Scotch" Plastic Tape simplifies tracing or servicing of fluid lines, electrical conduit, air ducts, and other in-plant systems. What's more, eight vivid colors—red, green, black, orange, yellow, blue, white, brown—and a variety of widths permit hundreds of code combinations. Won't chip, bake, or flake off. Resists acids, alkalies, greases, salts, and most solvents—lasts for years.

"Scotch" Plastic Tape is also excellent for lane marking and indicating storage zones or restricted areas on floors.

What's your marking problem? Chances are it can be solved with a "Scotch" Brand Tape. Ask your nearest "Scotch" Brand Tape Distributor or write: 3M Company, 900 Bush Avenue, St. Paul 6, Minn.

When tape costs so little, why take less than "SCOTCH" Brand?

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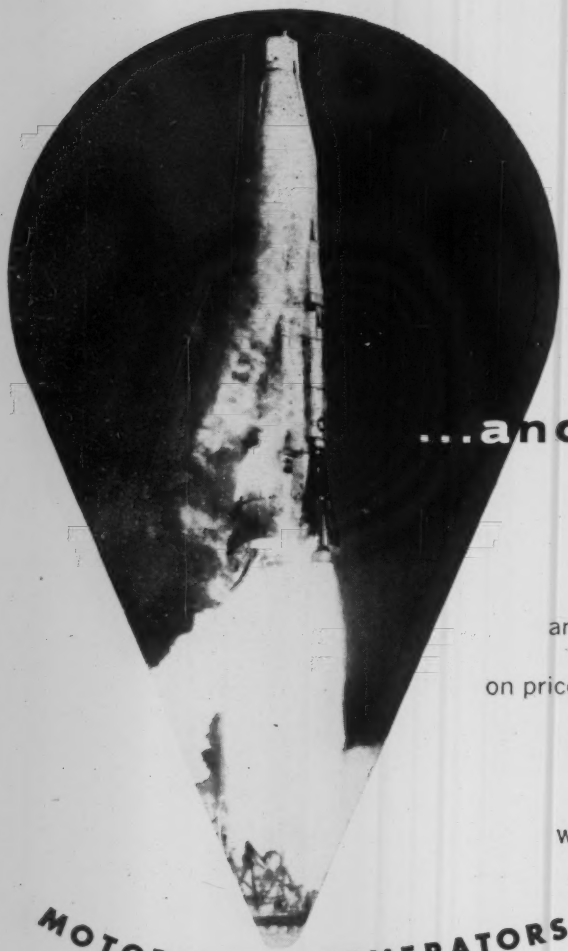

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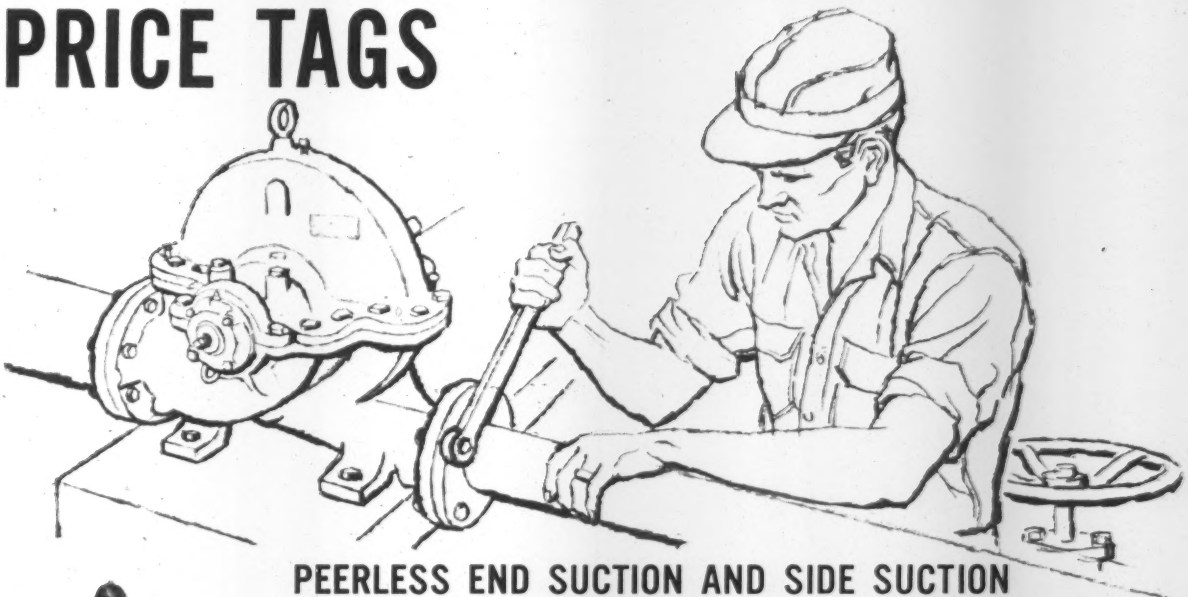

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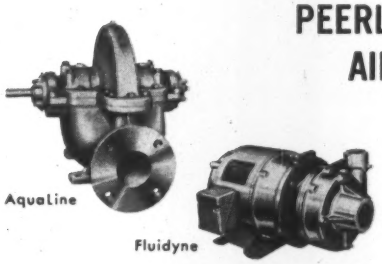

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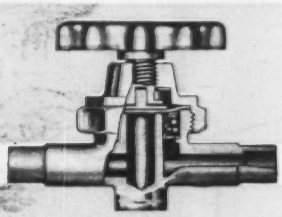
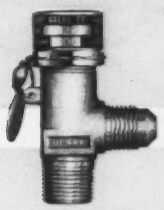


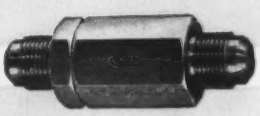
VALVES—Shut-off

Packless, Packed and Wing Cap Types
Integral and Flanged Connections



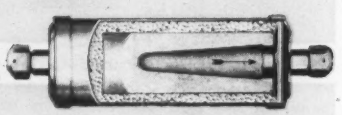
VALVES—Pressure Relief

Piston and Diaphragm Types for Atmospheric and Vent Line Applications



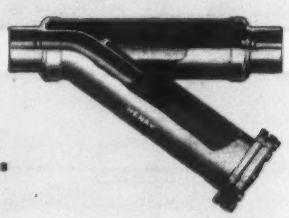
VALVES—Flow Check

Spring Loaded and Free Floating Types—also for water and air



FILTER-DRIERS & Driers

DRI-COR Sealed and Cartridge Types with Molded Core and Granular Desiccants



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R7

PROGRAMMING RELAY

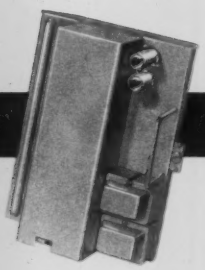
ANOTHER DIAMOND JUBILEE PRODUCT

HONEYWELL'S IMPROVED R478 *Gold* FOR A PURPOSE!

The new gold color is the result of a zinc-plated dichromate finish for better resistance to corrosive industrial atmospheres. But that's only one of a variety of new advantages making this new programming relay the most versatile, the most flexible, the *best* for commercial-industrial applications. These include packaged boilers, horizontal rotaries, steam and air atomizing oil burners, large power gas burners and combination oil-gas burners.

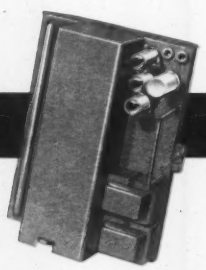
THE R478'S SIMPLIFIED DESIGN FEATURES:

- 50% fewer tubes . . . fewer parts mean longer life.
- Transistorized power supply—silicon diodes assure long, trouble-free operation.
- Simplified electronic timing—one tube provides pre-purge, post-purge, and trial for main flame ignition timings.
- Easy installation . . . fits same mounting cabinet as older model of the R478.
- Unsurpassed application versatility, sequencing flexibility, voltage selectability.
- Armored back . . . a back cover plate protects wires and components when relay is out of the cabinet.



THE NEW R478A programming relay can be used with Honeywell's foolproof C7012 ultraviolet flame detector to sense both gas and oil flames. It can also be used with either flame rods or standard photocells.

THE R478B includes all the features now incorporated into the R478A. The B model is designed especially for use with a lead sulfide cell to detect both oil and gas flames.



THE R4074 is designed for use with the smaller commercial-industrial burners and boilers. Like the R478B it is used with a lead sulfide cell to detect both gas and oil flames. The R4074 also incorporates all the new features built into the new R478s.

UL FM

Whatever your commercial or industrial safety problem, you'll have the BEST in a flame safeguard performance with the Honeywell line . . . Built to last, built to perform best, built for easy installation, trouble-free maintenance. Ask your Honeywell representative to PROVE it to you!

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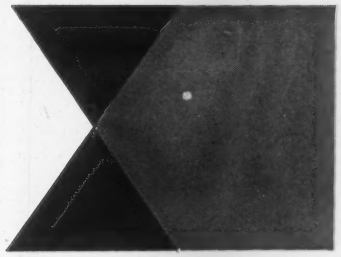
76-8815 Printed in U.S.A.

We follow here each month the practice at engineering society meetings of providing an "open for discussion" period. You are urged to take part. Just address your comments to the Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.



"Open for Discussion"

4-Year-Old Installation Supports Claims for Solar Energy Heat Pump

I HAVE READ with interest the article, *Will Solar Energy Be the Heat Source for Tomorrow's Heat Pump?*, by E. B. Penrod and K. V. Prasanna (May). We are, of course, pleased to see interest in the combination of solar energy and the heat pump since we have been advocating this for several years.

Our solar heated office building (Heating, Piping & Air Conditioning, October 1956, pp. 104-107) utilizes a heat pump, solar collector, and water storage system. We have operated successfully for four heating seasons at a cost of about two-thirds of that which would be incurred by using a conventional system. This is at present rates of about 85 cents per 1000 cu ft of gas, and from 1.5 to 2 cents per kwhr for electricity.

We feel, therefore, that the system described by Dr. Penrod and Mr. Prasanna has considerable merit, and their estimates of its economics are conservative.

ROGER W. HAINES
Chief Engineer
Bridgers & Paxton
Consulting Engineers

Use Condenser Water "Free Heat" To Boost Efficiency, Cut Costs

USING condenser water reheat in the primary air system of a conventional two-pipe system is a wonderful idea, as pointed out in the article, *How To Operate Induction Unit Systems When Changeover Point is Subfreezing*, by Hem C. Gupta (May, June). This is basically using "free heat" for reheat since it comes from the condenser water which must dispose of heat in some way anyhow. We have used this approach many times to improve the operating efficiency of the system. Generally, we have found that the operating cost is reduced considerably at a slight increase in first cost (for some additional piping).

Usually, we have applied this approach at a different time of the year than considered in Mr. Gupta's article. Condenser water reheat is available anytime the refrigeration machine is operating and will actually do a better job during the warmer months. The normal outside temperature at which reheat in the primary air systems begins is around 75 F. At this time the refrigeration machine will be almost fully loaded and a small amount of the condenser water is tapped off for reheat in the primary air system. The rest of the condenser water heat is disposed of in the cooling tower.

This method of operation works very well down to about 40 or 45 F. Below these outdoor temperatures, the refrigeration machine can be turned off entirely and the secondary water cooled by the outside air. We have found this to be a most practical and efficient way to operate a conventional two-pipe induction system.

In certain buildings, we have found it very practical to use two refrigeration machines with a small machine to cool the secondary water and heat the primary air during the cooler months. This is particularly true in larger buildings where more than one refrigeration machine is required. For example, in a building requiring 1000 tons, two machines will normally be used. One may be 700 tons and the other 300 tons. During the peak summer load both machines are required to cool the air and water in the system. When the outside air load decreases sufficiently, the smaller of the two machines could be turned off. As the load continues to decrease, the larger machine is turned off and the smaller machine turned on. Generally, this latter operation would occur at around 45 or 50 F outside temperature, making it very convenient to hook up this machine to operate as a heat pump on the primary air and secondary water systems.

"Open for Discussion"

Continued

This method of operation increases the operating efficiency of the whole system by keeping the refrigeration machines at full load or close to it. It also improves the efficiency by using "free" heat for reheat purposes.

W. F. Stockford
Product Sales Dept.
Machinery and Systems Div.
Carrier Corp.

The author's reply — I am very grateful to receive these interesting comments from Mr. Stockford. It is true that when the outdoor air temperature is somewhere between, say, 45 and 75 F, the condenser heat can be used for providing reheat to the primary air. However, to accomplish this, it will be necessary to cross-connect the reheat coils to the condenser water system as well as to the normal hot water system. In many applications, during such periods when the outdoor air temperature is above 45 F, the primary air reheat requirements may not be great enough to warrant this additional investment in the piping and the controls. This arrangement, of course, could not possibly be practical for systems designed to utilize steam for reheat.

Mr. Stockford indicates that when the outdoor air temperature is below 40 to 45 F, the refrigeration machine can be turned off entirely and the secondary water can be cooled by the outside air. This is a very good idea. But, in my opinion, it can only be incorporated in buildings in which the use of glass for the exterior and the lighting load are limited.

The secondary water can be cooled by the outdoor air either by using the cooling coil in the central air handling unit as a dry coil or as a sprayed type coil.

In a two-pipe induction unit system the primary air compensates for practically all the transmission loss through the space. Therefore the cooling requirements imposed on the secondary water system are significant even during the colder months.

In practice, the temperature of the air entering the cooling coils cannot be maintained below 40 F because of possible freezing. Therefore, during colder months, the outdoor air will have to be either preheated to 40 F or mixed with the return air before it can be used for cooling the secondary water. The secondary water, on the other hand, has to be about 53 to 55 F in order to provide sufficient cooling for the induction units on the south exposure. Consequently (if the cooling coil is not sprayed), the primary air cannot extract sufficient heat from the secondary water due to a rather low temperature difference available between the primary air and the secondary water.

In most applications a sprayed type cooling coil cannot be used to cool the secondary water because it will result in excessive relative humidity in the space. When the outdoor temperature is in the 20s, the relative humidity in the space cannot be greater than 30 percent. Otherwise there may be visible condensation on the windows. Allowing for latent load in the space (approximately a 10 grain pickup), the maximum dewpoint temperature of the air leaving the sprayed coils required will be about 35 F. In other words, for using primary air as a source of providing cooling for the secondary water, its wet bulb temperature entering the cooling coil will have to be lower than 35 F. This is obviously impractical.

I therefore feel that the cooling of the secondary water by the outside air may only be practical for buildings in which the use of glass and the lighting load are very limited. On the other hand, in any application, it will be possible to cool the secondary water by the refrigeration machine, simultaneously using the condenser water for primary air reheat.

Hem C. Gupta
Design Engineer
A. Epstein and Sons, Inc.
Consulting Engineers

Plant Exhaust Article Is Valuable To Ventilation Designers

The article, *Supply Makeup Air for Plant Exhaust Without Adding to Heating Costs*, by H. P. Kaulfuss (June), is not only well written, but contains a great deal of meat that could be of value to designers of ventilating and dust collection systems in all plants — but particularly in plants with high heat outputs such as foundries or forge shops.

As he says, supplying air from an outside source, particularly when it does not have to be heated or filtered, certainly can reduce the heating cost. By supplying air in an excess to that exhausted from a room or a plant, all equipment can work at its designed volume and pressure, rather than being hampered by additional negative pressure when makeup is not provided in the proper volumes. We have seen some cases where, due to the lack of adequate makeup air, some of the hoods on shakeout stations or pouring loops in foundries actually were operating in reverse.

The unheated makeup air admitted to some plants can be permitted to go as high as 80 percent of the total volume exhausted under the right conditions of outside temperature, plant heating requirements, and worker locations. But in others, this volume may have to be reduced considerably because of some of the other factors in work. As long as the unheated air is introduced in a position where it does not pass by a worker or is not added in sufficient volume to reduce the in-draft of plant air to a point where it

cannot control the fumes and dusts satisfactorily, it is certainly a worthwhile saving. Again, it is obvious that whether this air be heated and filtered or whether it simply be allowed to enter the building at certain spots, a propeller fan or a vaneaxial fan to more or less control the volume introduced at any one spot is certainly important if the building is in reasonably good balance.

I believe this article and more like it would be very helpful in furthering a better understanding of ways and means of doing an adequate job at a moderate price.

JOHN G. LISKOW
Sales Manager
Dust Control Products
American Air Filter Co., Inc.

Separate, Local Exhaust for Cooking Appliances Is Only Proper Solution

SINCE THE American Gas Association has just published a design manual, "Commercial Kitchen Ventilation," which I prepared, I was quite interested in the Question of the Month section of your May and June issues in which T.R.B. asked "*How Should I Ventilate a Large Cafeteria Kitchen?*" (This new manual is available from the American Gas Association, 420 Lexington Ave., New York 17, N.Y., at 50 cents a copy.)

Based on my rather extensive experience in this field, I wish to compliment Harry E. Seifert for the very fine answer he provided in the May issue. I am in complete accord with Mr. Seifert's analysis and recommendations. In particular, he is absolutely correct in stating that a separate and local exhaust system for the cooking appliances is the only proper solution. Dependence upon the building ventilation system will never prove satisfactory. It is possible, however, that we both may be in error in assuming that the present cafeteria kitchen does not already have a local exhaust system.

If it is true that a hood and exhaust system for the cooking appliances now exists, the high kitchen temperature described by T.R.B. should not occur, providing the system is designed and operating properly. This can only be determined by an on-the-job inspection by someone qualified in ventilation system design. However, it is feasible for the cafeteria operator to make a rather simple check to determine if the exhaust system is reasonably adequate. This can be done as follows:

1) From catalog data or rating plate on the fan, obtain cfm fan capacity at an assumed static pressure of 1 in. water gage.

2) Multiply this cfm rating by 60 to obtain the hourly air exhaust volume.

3) Obtain the cubical contents of the kitchen.

4) Item (2) divided by item (3) will give the number of air changes in the kitchen per hour.

If the hourly air change rate from item (4) is not greater than 20, the exhaust system is probably undersized and will need to be modified and enlarged. If the air changes exceed 20, the exhaust system should be adequate to prevent high kitchen temperatures. But since it does not, something other than fan capacity is involved, and checking by an expert is called for.

The design fundamentals discussed in the aforementioned manual should be of considerable help to T.R.B. and to others interested in this subject.

EDGAR A. JAHN
Assistant Director
Utilization Bureau
American Gas Association

Wouldn't 2000 Fpm Air Discharge Be Uncomfortable at Worker Level?

THE ARTICLE, *Ultra-Modern Engine Plant Demands Unique Heating, Ventilating Systems*, by Lester S. Ries (May), is interesting in many ways. It would seem that air discharging at a height of 10 ft above the floor and at something over 2000 fpm would create uncomfortable conditions at the worker level. What is the temperature of the air at the outlet? Also, blowing heated air a distance of 100 ft to an unheated west wall, and maintaining a sufficient blanket of warm air at this point seems incredible. Please elaborate on this feature.

I like the idea of having drains installed between the filters and coils, as maintaining units in the truss areas is difficult. In this way, maintenance through washing reduces costs considerably.

The author mentions the use of air washers in some areas and indicates a design of 95 F dry bulb and 73 F wet bulb. The Guide lists the wet bulb at 75 F, and I have always felt that these listings were on the low side. The wet bulb for this area (Peoria, Ill.) is shown at 76 F, whereas we always design our systems at 78 or even 80 F WB.

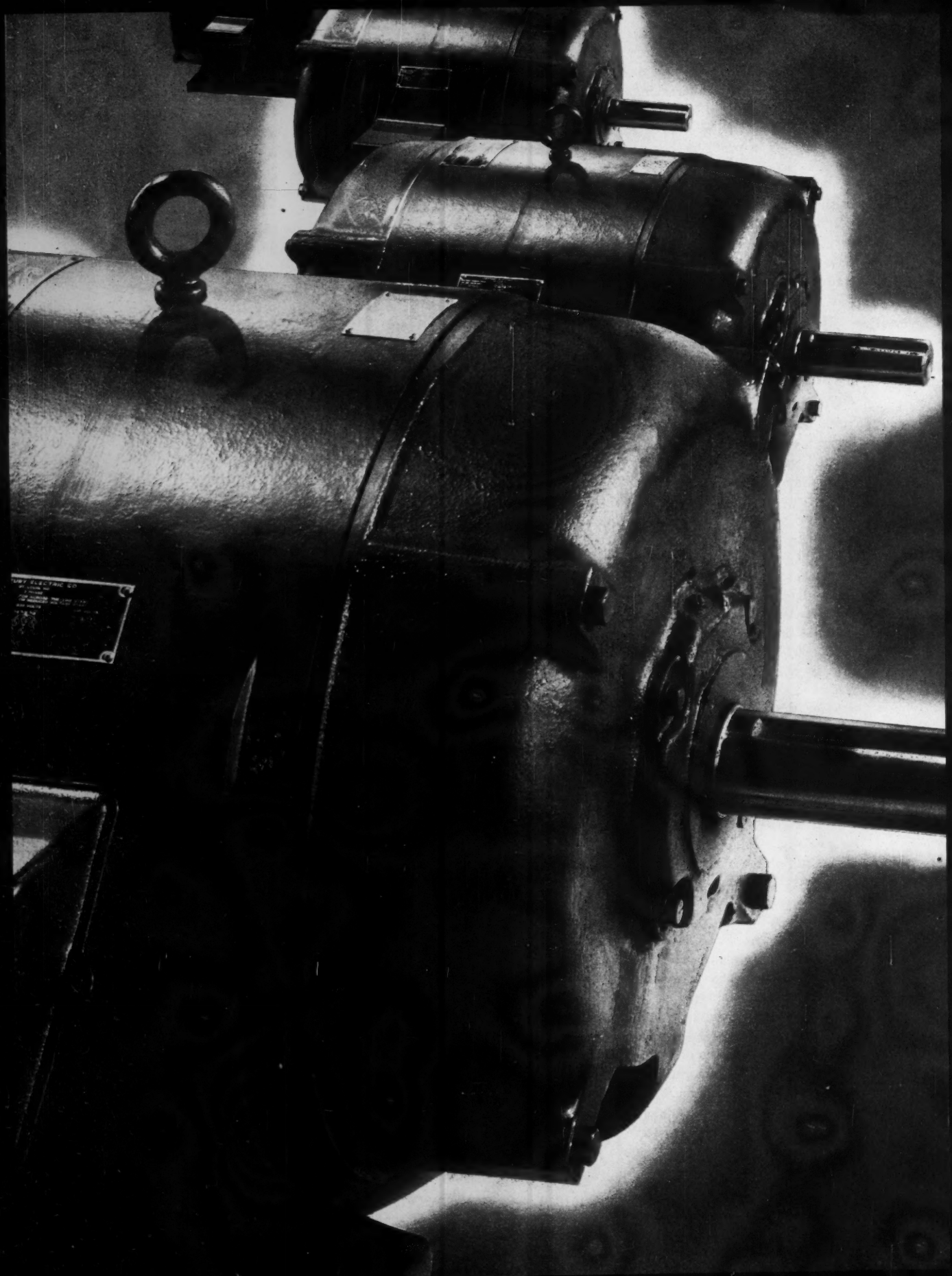
Since high velocities are indicated for the areas using evaporative cooling, could it be that the rapid air motion is providing much of the cooling effect?

Tempering of the outside air by passing it over the heated mufflers will certainly conserve steam, and should be commended.

H. P. KAULFUSS
Staff Engineer
Peoria Plant Engineering
Caterpillar Tractor Co.

THE AUTHOR'S REPLY — The supply air discharging at a height of 10 ft above the floor at 1800 to 2000 fpm is 72 F at the supply outlet in the assembly area and 66 F in the test area. The best answer to the comfort conditions at the worker level is the record cited by the management. Practically no complaints

(*Continued on page 96*)

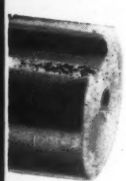


1960–16,450,000 horsepower
1965–26,000,000 horsepower

Conservative estimates place the total horsepower of all motors driving fans and blowers in the United States at about 16,450,000 horsepower. And in 1965 it is estimated that the total will be about 26,000,000 . . . an annual growth of 5% for the air moving industry. To make sure all this equipment gives top performance requires careful matching of motor to equipment . . . and a wide variety of different types of motors. Century Electric application engineers can help you select the right motor for your fans, blowers and allied equipment:

For fans—Two basic types of motors, CS and CP, meet most requirements for fans operating from single phase power. Both these Century Electric capacitor start motors provide high starting torque. Fans operating from polyphase power perform best with SC and SCM motors.

For blowers—If the starting load is light or if there will be short time increases in load, then the Century Electric Type SC polyphase motor is ideal. It will give you enough starting torque, and with low starting current. It comes in ⅙ to 400 hp sizes. If you need two, three or four different fixed speeds while the blower is running, the Century SCM polyphase motor will do the job.



For compressors—Where high starting torque is required to overcome great inertia or backpressure, the Century Electric Type SCH polyphase motor is right. This motor comes in sizes ranging from three to 400 hp and in dripproof, totally-enclosed and explosion-proof enclosures. It also provides the right kind of power to drive reciprocating pumps with high starting torque requirements.

For pumps—Centrifugal pumps, whose torque demands increase with speed, perform best with Century Electric SC polyphase motors. Reciprocating pumps with high starting torque requirements need the SCH. For all types of pumps, as well as for compressors and blowers, Century Electric makes single phase motors.

For special applications—Century Electric makes a variety of motors for specific operating conditions. The shaft-mounted fan motor is designed for unit heaters and evaporators. It comes in ⅓ to 3 hp sizes. Hermetic motors can be built right into a refrigeration compressor unit . . . they are manufactured under rigid quality controls to make sure they are free of contaminants that could damage capillary tubes and valves.

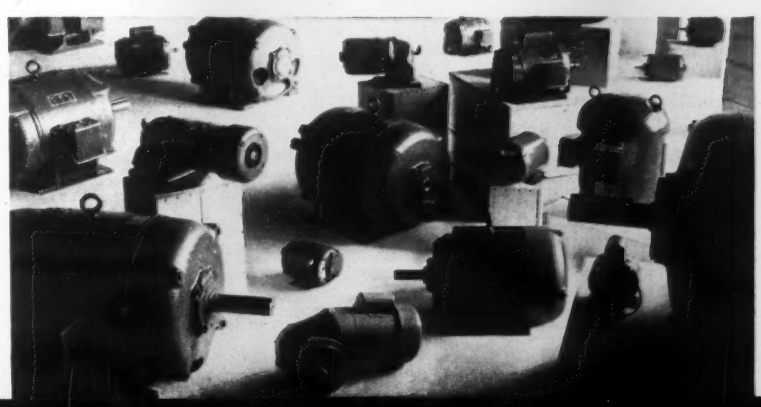
FOR MORE INFORMATION—Please contact your nearest Century Electric Sales Office or Authorized Distributor. You will find Century Electric's new Motor Application Guide helpful . . . please write for bulletin 270A. For *more* than a motor . . .

CENTURY ELECTRIC COMPANY

St. Louis 3, Missouri *Offices and Stock Points in Principal Cities*

Century 59-8A

FROM OVER 10,000 TYPES of motors—AC and DC . . . single phase and polyphase . . . from 1/20 to 400 hp—you can find the right one from Century Electric for your application . . . the one that provides the best performance commensurate with cost.



"Open for Discussion"

Continued from page 93

have been received from the occupants after the initial period of system balancing.

In the northwest corner of the building, where the air flow is from east to west to blanket the unprotected west wall, the temperature of the air at the supply outlet is 75 F. There is no annoying turblence adjacent to the wall and there is no noticeable temperature differential. The three paint booths in the area require 40,000 cfm of makeup air which tends to stabilize conditions.

The drain installed between the filters and coils is of great help in expediting the cleaning operation here.

LESTER S. RIES
Consulting Engineer

Queries Author About Temperatures In Dehumidifying Cooling Coils

I HAVE READ with great interest the article, *New Design Tool Permits Quick, Accurate Selection of Dehumidifying Cooling Coils*, by T. W. Ernst (January). The following questions occur to me:

1) From Fig. 4 it appears that the leaving dry bulb temperature is dependent on the entering air dewpoint and leaving air wet bulb temperatures only. Without going into extensive calculations, I feel that the entering chilled water temperature and perhaps the water temperature rise must have an influence on the leaving dry bulb temperature. Will it not be that? With the same entering conditions and leaving wet bulb temperature, is it not true that the leaving dry bulb temperature will be higher for a lower water entering temperature? (The number of rows required in the coil will, of course, vary with the water entering temperature.)

2) Is it right to assume that, for higher altitudes (lower air densities) and the same air entering conditions, the leaving air conditions will be the same as for sea level if the conditions are expressed in dry bulb temperature and dewpoint? The Btu capacity and water flow rate are reduced accordingly.

P. SIMONIS
Fulmark Engineering Co. (Pty.) Ltd.
Johannesburg, South Africa

THE AUTHOR'S REPLY — Fig. 4 does permit the determination of leaving dry bulb temperature, knowing only the leaving wet bulb and entering dewpoint temperatures. This chart is derived from a plot, based on actual test results of the leaving air condition lines on a psychrometric chart. For any coil, therefore, the leaving air condition points fall on the condition line for a given entering dewpoint. Exhaustive tests with varying conditions on a variety of fin-tube configurations showed that these condition lines are independent of the type of surface, number of rows, fin spacing, fin thickness, tube spacing, face velocity, water or refrigerant temperatures, water velocity, or water temperature rise for a coil circuited in the usual counterflow manner. We might add that an independent source has arrived at similar conclusions, based on their own test program.

In answer to the second question, we have developed altitude correction factors to use with the new selection method for dehumidifying cooling coils. These take into consideration that:

1) All of our basic coil selection charts are based on standard sea level conditions (14.7 psia, 70 F or an air density of 0.075 lb per cu ft).

2) The total heat content of air (enthalpy, Btu per lb) increases as the altitude increases. This means an increase in the total cooling load in Btu per hr.

3) The increased cooling load is partially offset by a slight increase in the effective heat transfer coefficient because of the higher proportional latent load. The net result for a higher altitude condition is that more surface is required.

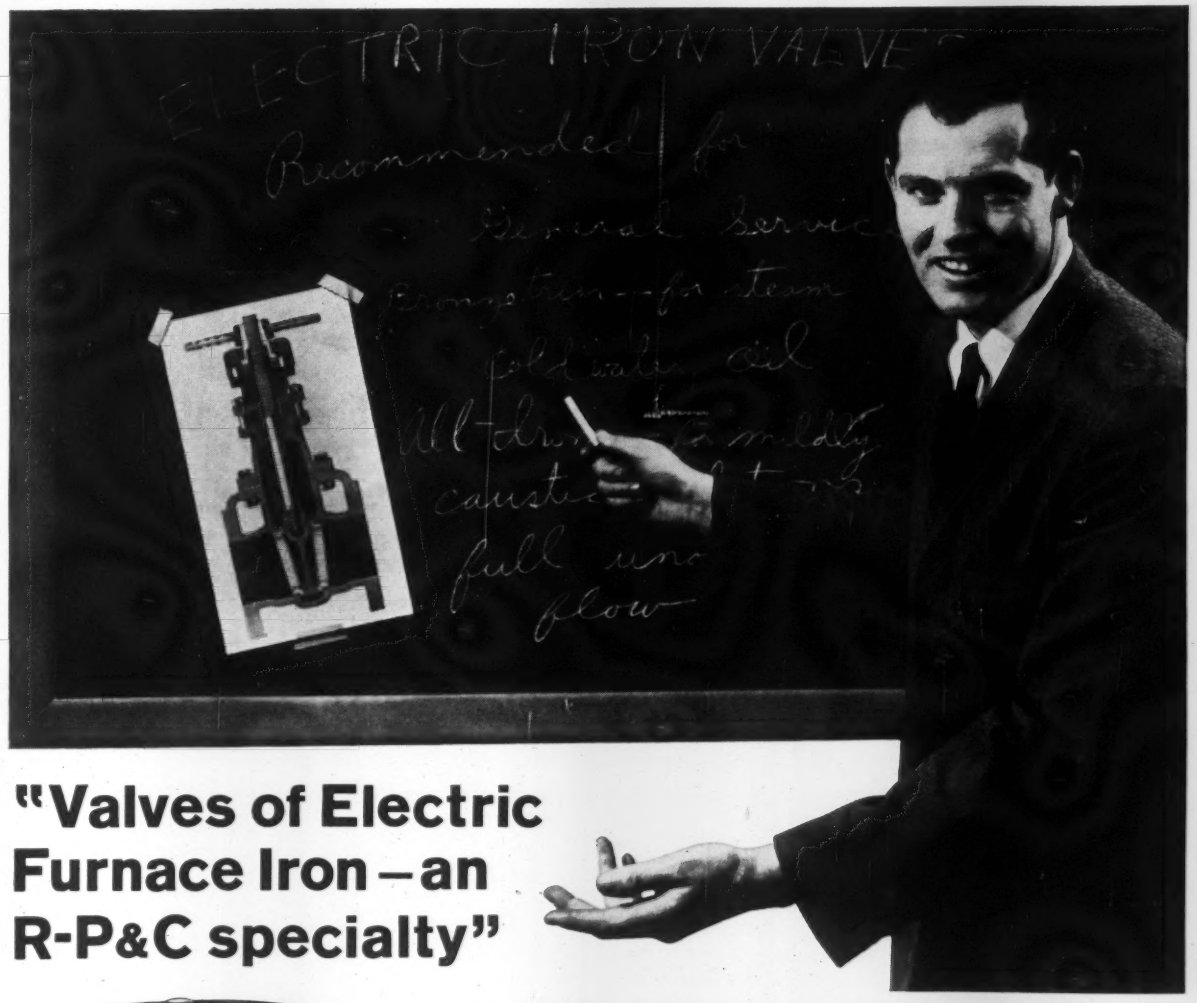
T. W. ERNST
Manager, Coil Sales Dept.
The Trane Co.

READER ASKS—

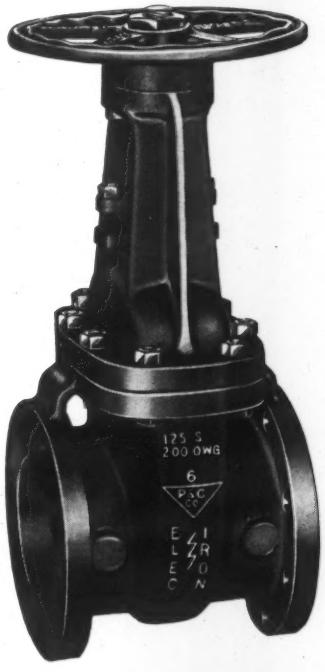
"How Should We Size Relief Valves for HTHW Water-to-Steam Convertors?"

"Water-to-steam convertors are required in many high temperature hot water heating systems. An important part of the design of the convertor is the sizing of the relief valve. We have been unable to locate specific data covering this. We would like to know whether such data exists and, if so, where it can be found. Also, we would like to know how other designers size relief valves for this application."—J.S.B.

• *YOU ARE INVITED to contribute a question for publication or an answer to a published question. Write: The Editors, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2.*



"Valves of Electric Furnace Iron—an R-P&C specialty"



"Manufacturing castings from iron melted in our own electric furnaces and to our own specifications has long been an R-P&C specialty. Recognized for their superior quality, these castings of **highly refined metal** are substantially free of impurities. Dense grain structure gives them a high resistance to corrosion, high tensile and transverse strength, plus excellent deflection characteristics. In fact, their **physical properties far exceed** the standard requirements for iron valve castings. And all of these advantages are available to you in R-P&C Electric Furnace Iron Valves at no extra cost."

Shown here is an R-P&C Gate Valve of the flanged end type. It is available in sizes from 2" to 24" in bronze trim or all-iron construction. The R-P&C Iron Valve line includes other popular types of Gate, Globe, Angle and Swing Check Valves—all made of Electric Furnace Iron.

Contact your R-P&C distributor. He can supply you promptly with any Iron Valve you need as well as gate, globe, angle and check valves in bronze, cast steel and forged steel; all in a wide range of sizes, styles and pressure classes. See him or write...

R-P&C VALVES

ACCO

R-P&C Valve Division, American Chain & Cable Company, Inc.

Reading, Pa., Atlanta, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

question of the month

"What Is Life Expectancy of HPAC Equipment?"

This question was asked previously in Heating, Piping & Air Conditioning and is repeated here, along with an answer that has been received from a reader. Other solutions or comments for publication are invited.

"We are in need of knowing where up-to-date information can be obtained on the expected life of heating, piping, and air conditioning equipment for large building installations. We have recommended a composite life of 15 years for a large air conditioning system in one office building, and the manufacturer has recommended that about $60,000 of the cost should be depreciated over a 10-year period and the remainder such as ducts, etc., should be depreciated over a 15-year period. When the Internal Revenue agents examined our return, a 20-year life was substituted and we did not question or protest the change.

"In view of these different recommendations, we would like to see some reliable and up-to-date information on this subject."—H.G.C.

It Depends on Use, Service Requirements of Equipment

WHEN SELECTING amortizing time, the owner's accounting practices usually influence the payout period. For tax purposes, the time depends upon use and service of the respective equipment.

Frequently, obsolescence rather than wear is the influencing factor. This is necessary to allow replacement with newer, more efficient equipment permitting lower operating cost.

Usually, the decision of the Bureau of Internal Revenue is final, although they may accept some minor differences. For depreciation purposes, useful life of most air conditioning equipment is assumed to be 20 years. However, discussion with tax experts may indicate a shorter life can be used and be acceptable to the government.

Schedule F, prepared by the Bureau of Internal Revenue, can be used as a conservative guide. The following table lists probable useful life periods given in Schedule F. Also included are time periods frequently employed for tax purposes as well as for cost estimates.

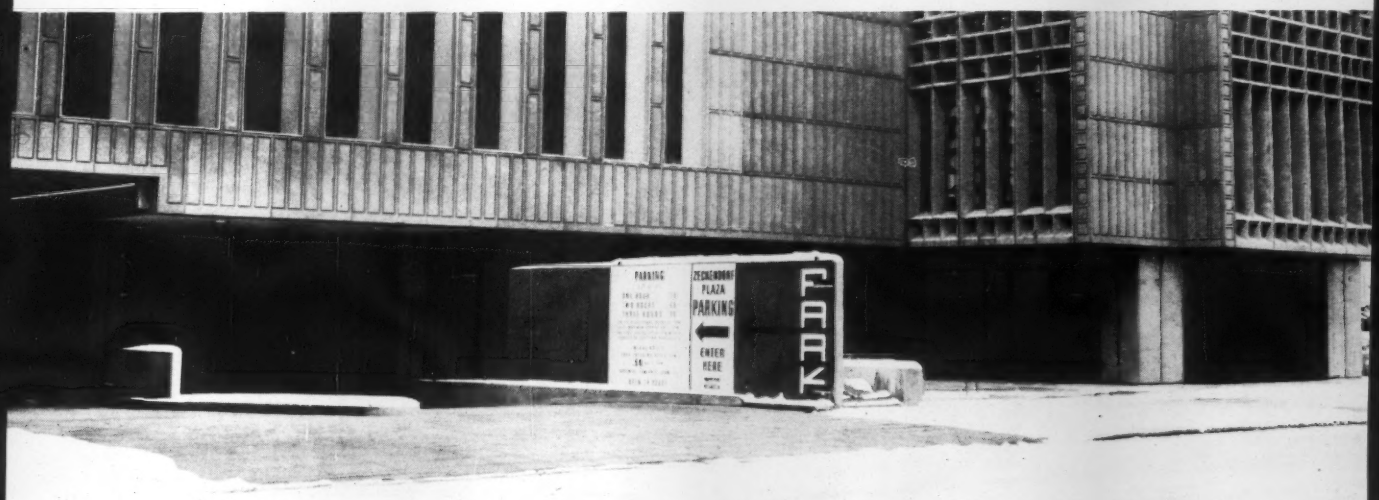
Item	Years*	Years**
Heat producing equipment		
Boilers	15	15
Stokers and burners	20	10
Heat distributing equipment		
Iron piping	20	10
Copper piping	Bldg. life	20
Concealed radiation	25	15
Direct radiation	25	10
Valves and specialties	10	5
Air handling equipment		
Automatic filters	20	10
Heating and cooling coils	20	10
Spray humidifiers and dehumidifiers	10	10
Fans	15	15
Air conditioning units	10	10
Motors and starting equipment	20	15
Pneumatic and electric control systems	15	10
Air distributing equipment		
Ductwork	Bldg. life	20
Duct insulation	20	20
Diffusers and grilles	20	20
Refrigerating equipment		
Reciprocating compressors	20	10
Centrifugal compressors	20	15
Motors and starting equipment	20	15
Pumps	20	15
Steel piping	20	10
Copper piping	Bldg. life	20
Water conservation facilities		
Evaporative condensers	15	10
Cooling towers	15	10
Wells	25	10

*Per Schedule F, Bureau of Internal Revenue.
**Assumed life for depreciation studies.

Action was undertaken by Congress last November to review present depreciation requirements by the bureau. The House Ways and Means Committee sponsored the study. It is believed the committee will soon recommend revision of the present revenue code to make it more realistic with present-day economic conditions.

H. B. WAYNE
Consulting Engineer

Now—while the weather's good, sell them



a SpanGrid Steel Pipe snow melting system!

Right now the readers of Factory Magazine and Purchasing Magazine—your customers and prospects—are looking at the two pictures above and thinking about the advantages of having a snow melting system at their plants or office buildings.

So, right about now you ought to be making calls on these people to nail down an order for a snow melting system with SPANGRID Steel Pipe while the weather's right and they're in the mood.

Want some sales points? Here's what we told them. With a SPANGRID snow melting system under walks or drives, it's "business as usual" all year around. No more snow shovelling, spreading ashes, scattering salt or chemicals. This saves money on manpower and materials. No delays for traffic. An accident hazard is eliminated. Paving is not damaged by chemical action.

We also told them briefly how the system works and that SPANGRID Steel Pipe would give them years of trouble-free service. If you've used SPANGRID, you know it's a top-quality product, uniform throughout, quality-controlled, tested and inspected thoroughly, and is especially suited for snow melting, radiant heating, refrigeration and ice rink use.

Need additional information? Complete details on costs and installation are available in the booklet "Snow Melting Systems." We'll be glad to send you a copy. Just mail the coupon. And when you make your sales, be sure to install SPANGRID Steel Pipe . . . made in U.S.A.

SPANG CW® STEEL PIPE

THE NATIONAL SUPPLY COMPANY

Two Gateway Center, Pittsburgh 22, Pennsylvania

Subsidiary of Armco Steel Corporation ARMCO®

The National Supply Company, Tubular Division
2 Gateway Center, Pittsburgh 22, Penna.

Please send me a copy of "Snow Melting Systems."

Name _____

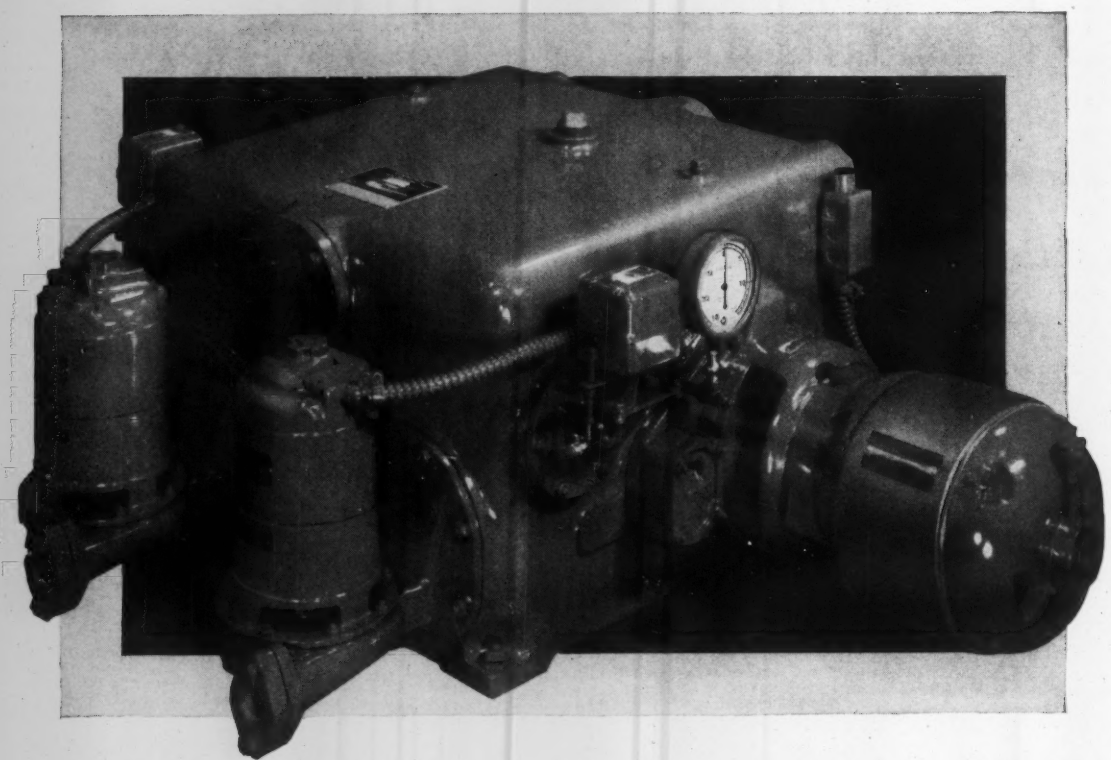
Title _____

Company _____

Address _____

City _____ Zone _____ State _____

THIS NEW VACUUM HEATING PUMP IS SIZED TO ACTUAL JOB REQUIREMENTS



It's the Nash CSM

No longer is it necessary for the Engineer to accept a vacuum heating pump with air and water capacities based inflexibly upon square feet of equivalent direct radiation. With the flexible Nash CSM he can provide for proper air capacity in accordance with his judgment and experience. For the individual capacities of the separate pumps on the CSM may be varied within a wide range, without buying an oversize receiver and oversize water pumps.

These pumps possess many other features which permit a more efficient utilization of fuel and minimum use of electric power. Low, low, returns reduce installation costs and usually eliminate putting the pump in a pit. Simplicity and efficient operation reduce supervision and maintenance costs. Information regarding this new heating pump development is available immediately upon request.

- Increased air capacity induces rapid system response without wasteful overheating.
- Separate air and water pumps individually selected to meet actual job requirements.
- Control system that operates individual pumps only when needed.
- Flexibility permitting addition of radiation without changing basic pump installation.
- Low, low, return line connection.

NASH ENGINEERING COMPANY
438 WILSON, SO. NORWALK, CONN.

SULPHUR PIPING SYSTEM — for conveying 4500 tons per day — was installed by fabricating 1000 ft lengths, hydraulic testing, assembling tube bundle. These 1000 ft sections were joined into 2000 ft lengths for launching

Trace 7-Mile Underwater Sulphur Piping System with 320 F Water

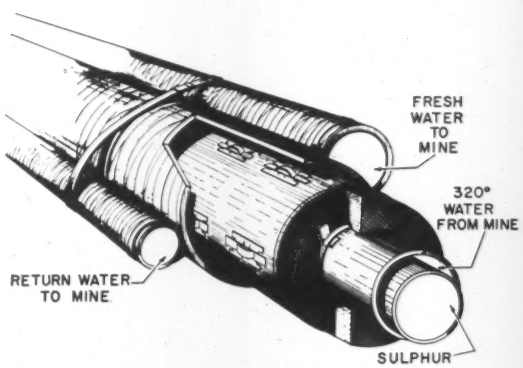
. . . to provide uniform pumping characteristics and to keep sulphur from freezing

By C. M. COCKRELL
Chief Design Engineer
Freeport Sulphur Co.

DESIGNING an underwater piping system for transporting 4500 tons of sulphur per day is tricky when it is realized that sulphur freezes at 240 F and the maximum temperature that can be tolerated is 320 F.

A detailed study was made of the transportation of this quantity of sulphur 33,000 ft from the Grand Isle Sulphur Mine in the Gulf of Mexico to the Louisiana shore, and an underwater pipeline for molten sulphur was found to be the most attractive, both in cost and in dependability. The sulphur deposit is in 50 ft of water in the Gulf of Mexico, seven miles off shore from Grand Isle, La.

Because of the relatively narrow temperature range



1 FINAL DESIGN consists of concentric line, with internal line for sulphur and annulus for heating water. Both inner lines are at same temperature

● The world's first offshore sulphur mine is capable of producing 4500 tons of sulphur daily through an underwater piping system. Buried 5 ft in the ocean floor, this seven-mile concentric system comprises a 6 in. internal pipeline surrounded by a trace line conveying 320 F water to keep the sulphur from freezing (at 240 F) enroute from the mine to a barge loading point. This article will briefly discuss the system's design features and will review some of the problems encountered in its development.

Mr. Cockrell received his BSME from Texas A & M in 1927 and his ME from VPI three years later. In his 30 odd years with Freeport Sulphur Co. he has integrated from machine shop helper to chief design engineer. His principal duties have been in the mechanical and process design field involving heat transfer, power, materials handling, and piping. He is credited with several design "firsts" in the field of sulphur mining.

through which the molten sulphur can be pumped, the pipeline must be heated and controlled constantly. Normally, steam is used to heat sulphur lines, but the length of this line would create too great a pressure drop in the steam to maintain the desired temperatures. Therefore, it was decided to use heated water, with the water and sulphur flowing in the same direction with the same temperature drop.

The sulphur line was first sized for a single-stage submerged pump which required a large pipe size. Because of this, an excessive heat loss would be experienced. This, however, was corrected by substituting suitable high pressure pumps and a resulting smaller pipe size. Thus, the initial concept in the design was an insulated sulphur line with an outer casing to keep the insulation dry and an internal water line for heating. Condensate was concluded to be the only satisfactory nonscaling, noncorrosive water available for heating.

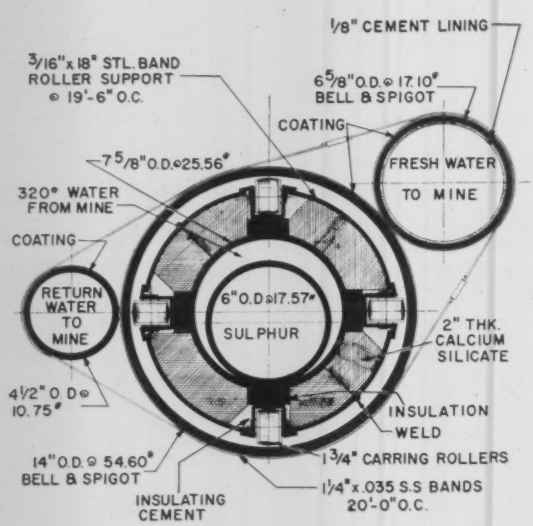
The final design consisted of a concentric line, with the internal line for sulphur and the annulus for the heating water, as shown in Fig. 1. Therefore, both the inner lines are at the same temperature which eliminates the stress problem created by differential expansion movements.

Other advantages of this arrangement are that a better heatup condition is afforded, a better stress distribution will be experienced, and an easier welding condition is provided.

Use Seamless 6 In. Pipe for Sulphur

In determining the pipe size for the sulphur line, 6 in. OD seamless high strength steel was selected which would permit operation at the necessary 900 psi.

The pipe size for the water jacket was determined



2 CROSS-SECTION of underwater sulphur pipeline bundle at rollers shown at left. Rollers reduce working stresses, permit inner lines to be pulled out for repairs

3 INSTALLATION of insulation and antifriction rollers was completed in the field, as shown at right

to be 7⅝ in. so as to handle the 100 gpm of heating water at a calculated resistance of 1000 psi and an additional 200 psi for the 4½ in. return water line.

The casing size for these two concentric pipes was selected as 14 in. from an economical balance of heat loss characteristics and construction costs. Consideration was also given to pipeline bundle density, soil loading, and suspension stresses which worked out satisfactorily when the 6⅝ in. fresh water line was incorporated into the piping system for the additional bearing area.

This fresh water line is banded to the side of the 14 in. casing with the 4½ in. return water line on the opposite side, as shown in Fig. 2. The fresh water line is cement-lined and the 6⅝ in. size offers some future capacity if additional water becomes necessary.

Design for Expansion of Inner Lines

At the average operating temperature of 300 F, the two inner lines have an expansion of 58 ft if allowed to move, or a stress of 43,000 psi is produced if contained. By selective prestressing, the thermal stress is divided between tension in the cold condition and compression in the hot condition. Thus, the stress level was lowered which permitted a lower strength steel than would have normally been required for the pipe to be selected.

Steel pipe resists corrosion from sulphur at 300 F, also can handle hydrogen sulphide in the dry condition, but the presence of small percentages of water causes corrosion, and in a high-stress, high-strength steel can cause quick failure from hydrogen embrittlement cracking. Experience indicates steels of less than 22 Rockwell C hardness are less susceptible to embrittlement. The sulphur could leak into the jacket or water into the sulphur. Either could produce H_2S in the presence of water. Therefore, the steel considered for the inner lines was tested at the welded joint for embrittlement at various stress levels in H_2S solutions. The steel pipe selected with a minimum yield strength of 60,000 psi and less than 22 Rockwell C hardness met the physical requirement and successfully withstood the embrittlement test.

Antifriction Rollers Reduce Working Stresses

The long line has a high frictional resistance against moving the inner line assembly and is difficult to evaluate under all possible conditions. This led to the use of antifriction rollers to reduce the working stresses. These rollers also allow the inner lines to be pulled for repairs.

The design of the roller supports of two tandem rollers on each quadrant mounted on a bearing plate supported on calcium silicate insulation was decided after investigating many materials and arrangements. A roller bearing cam roller with a modified pin and long-life grease was found best suited for the requirements of a long service life, low friction, 150 F operating temperature, and providing an economically priced 3000 lb capacity roller assembly.

The bearing plates were made in halves for field installation on the pipe and each half was fitted with press steel bearing retainer boxes, spot welded to the plate, then the roller bearings were placed in the boxes and the pin fixed by crimping the box flange.

The plates were filled with 2 in. thick calcium-silicate thermal insulation and the hole in the insulation around the bearing was filled with insulating cement and a ¾ in. thick piece of high efficiency

4 FOR FIELD FABRICATION of piping, welding booth afforded protection from wind

thermal insulation installed over the bottom of each bearing box to conserve heat and reduce the temperature of the roller. These half section assemblies were installed on the 7⅝ in. OD pipe using a bonding filler, then the half bearing plates were tack-welded together.

At either end of roller assembly, angle clips were banded to the pipe to restrain longitudinal slippage. The calcium-silicate insulation at the roller was selected for its compressive strength and insulating qualities.

The insulation on the remainder of the line is 2¼ in. calcium silicate with kraft paper aluminum foil jacket selected for thermal resistivity, physical properties, availability, and service experience. Installation of the insulation and rollers is shown in Fig. 3.

A 40 ft section of the pipe assembly was fabricated and heated electrically for a test of the heat losses in air, in water, and buried in mud underwater. The results agreed very closely with the calculations, including the temperature across the air gap with the aluminum jacket on the insulation.

How System Was Fabricated

Low hydrogen welding offered the best joint for the 6 in. OD and 7⅝ in. OD high strength pipes, but was found difficult to perform in the field. A satisfactory procedure was developed using an inert-gas, tungsten-arc root pass with backup flux and a low hydrogen, iron powder electrode for manual welding of the remainder of the welds. The pipe was welded in accordance with standard pipeline practice. All welds were required to pass the American Petroleum Institute Standards for field welded pipeline and all welds were x-rayed. All joints except the 33 tie-in welds of the casing were hydraulic pressure tested and visually inspected.

The piping system was installed by fabricating 1000 ft lengths on the island, hydraulically testing and then assembling the three lines. This was followed by joining these into 2000 ft lengths, limited by the width of the island, for launching with hydraulic test on all joints except for the casing which contained the insulation.

The contractor elected to dig a trench with controlled alignment procedures to insure the straightness of the line. The horizontal portion of the riser assembly was attached to the first 2000 ft length and pulled seaward by a cable from an anchored winch barge, then the succeeding sections were welded on, x-rayed, and hydraulically tested until the full length of the line was in place. The fabrication required 52 days, the launching was done in 17 days, and 27 days were required to complete the adjustment.

At Grand Isle a heating plant was included to heat the sulphur as required principally at startup and low rate, to pump the fresh water from the barge to the mine, to control the cooling of the return water to about 130 F, to heat the fresh water to about 130 F, and serve as an emergency source of heat for the sulphur line such as shutdown of the mine during storms.

Material for this article was obtained from the engineering files and research reports of the Freeport Sulphur Co. and from consultants' reports of: *Oceanographic Study*, Texas A & M Research Foundation; *Feasibility Study*, Brown & Root Construction Co.; and *Soil Analysis*, Eustis Engineering Co.

This article has been adapted from a paper by the author, presented before the annual meeting of the American Society of Mechanical Engineers in Atlantic City last December. ∓

HTHW System's Operating Problems Uncover Valuable Design Rules

● Difficulties in maintaining vital HTHW-produced steam pressures in an Air Force medical clinic brought on an investigation which bared several points about HTHW systems that are often neglected in the design stage. This case history describes some of the system's operating problems, relates the attempts to solve them, and cites the conclusions made from the investigation.

Mr. Lynam studied physics at the National University of Ireland, coming to the U.S. in 1923. He has been in heating, ventilating, and air conditioning design since 1941 and first became interested in HTHW while on assignment in France in 1953-56. He is a licensed professional engineer in California.

By JOSEPH P. O'F. LYNAM
Senior Mechanical Designer
Daniel, Mann, Johnson & Mendenhall
& Associates. A Joint Venture
Architects & Engineers

IMPORTANT FACTS about high temperature hot water heating systems are too often ignored or discounted. Some of these were brought home to the writer by the following experience.

It was decided that a medical clinic be built on an Air Force base in France and that its heating, hot water, and steam requirements be supplied by the existing HTHW system which was of the cascade type and operated normally at 350 F. The clinic was located close to the remote end of a long feeder. All services from the system were controlled by two-way modulating valves with "constant-percentage" plugs, as is the practice in France.

The clinic was put in service early in winter and operation was normal for several months. But, with the advent of an early warm spell in spring, complaints came that it was impossible to maintain the specified 50 psig steam pressure.

A careful examination revealed that:

1) The HTHW temperature leaving the pump was 350 F and (for design conditions) the temperature at the control valve of the steam generator in the clinic had been calculated to be 346 F (or a drop of 4 F). Since the temperature of saturated steam at 50 psig is 297.5 F and the temperature of the HTHW leaving the generator must be at least 7 or 8 F higher, the unit was designed for a HTHW temperature drop of 346 − (297.5 + 7.5), or 41 F. Approximately 2650 lb per hr (5.95 gpm) of HTHW was required per 100 lb of steam produced and the generator design was based on a Log Mean temperature difference of ± 23 F.

2) In the warm afternoon when the control valves of the various space heating units had modulated to the closed or almost closed position, and little if any domestic water was being used, the pressure produced by the pump increased by several psi as a result of a greatly restricted flow. The pressure differ-

"Temperature drop along HTHW supply mains under minimum load conditions should always be carefully evaluated"

ential between the supply and return lines at the clinic increased almost to the full pump pressure differential from a very much lower pressure differential when the system was fully loaded. This, of course, was due to the virtual disappearance of line friction with the greatly reduced flow.

Nevertheless, even with the increased pressure across the valve and with the valve wide open, the generator was unable to maintain 50 psig pressure when the sterilizers in the clinic were in constant use.

The explanation of this was quite simple: With the great reduction of flow through the supply line, the drop in temperature between the boiler house and the clinic increased from about 4 F to as much as 40 F so that the supply temperature of the steam generator was only about 310 F. As a result, a Log Mean temperature difference of more than 8 to 10 F was not possible. There just was not enough heat transfer surface to produce the rated amount of steam.

Try Increasing Supply Temperature

The situation was corrected temporarily by raising the supply temperature at the boiler house by about 10 F. Later, an automatic bypass valve was installed at the end of the feeder, connecting the supply to the return line and arranged to open when the differential pressure approached the rated pressure of the pump. The bypass was sized to pass about 30 percent of the pump capacity, thus insuring that the temperature drop from the boiler house to the clinic should not exceed about 15 F at any time.

Under these conditions, the water level in the expansion tank was close to maximum. This, of course, was due to the high temperature of the return from the steam generator in the clinic, which contributed almost all the flow in the return line.

A few hours later, however, the level dropped close to the minimum when the steam generator load had greatly diminished and the load on the system consisted almost entirely of domestic water heating with the return from the heaters at a temperature of 150 to 160 F. This drop in level, as might be expected, was much less pronounced after the installation of the automatic bypass valve.

On the other hand, in cold weather when the load was predominantly space heating, the water level in the expansion tank varied only moderately from the midpoint. This was due to the return from converters which varied from about 230 F at full load down to about 220 F at minimum load, and the return from unit heaters in warehouses which were controlled in groups by automatic two-way valves and which varied from about 180 F at full load down to 70 or 80 F at minimum load. (In this installation converters accounted for about 85 percent of the space heating load, with unit heaters using HTHW directly accounting for the balance.)

What This Experience Shows

Certain conclusions might be drawn from this experience.

1) The temperature drop along supply mains under minimum load conditions should always be carefully evaluated, and an automatic bypass (either pressure or temperature controlled) should be installed at or close to the end of each main. The bypass should not come into action until a considerable drop in supply temperature or rise in pressure difference occurs. It should be capable of maintaining the supply temperature at all services (especially high temperature services) high enough for normal operation of each unit served.

2) It is usually impossible to reduce the supply temperature in summer to any significant extent if steam generators are served.

3) It is impossible to control boiler output by the water level in the expansion tank.

4) The expansion tank cannot be sized on the basis of assuming a range of temperature variation for supply and return lines. For a rational solution, the temperature variation in the return line must be analyzed, taking into account the temperature and volume of the return from each unit and its distance from the boiler house, plus the effect of the bypass (if any) at the end of the supply main.

After installation of the bypass, maximum water volume in the system would occur in the early morning hours in summer when all supply valves would be closed or almost closed and the average temperature in the system would be supply temperature minus about 15 F. Similarly, minimum volume would probably occur at a time when no steam load was on the line and when domestic water heaters (return temperature = ± 150 F) were operating close to capacity and sufficient space heating load (return from converters = 230 to 220 F) existed so that the bypass would be closed.

It would probably correspond to an average supply temperature of 345 F and an average return temperature of somewhere between 230 and 200 F, depending on the relative volumes returning from the two types of units and their positions on the line. ∓

Consulting Engineers Report Their Specification Practices

WHAT KIND of specifications does your firm write for heating, piping, and air conditioning installations?

Is there a change taking place in specifications that calls for a change in your present practice? If so, to what?

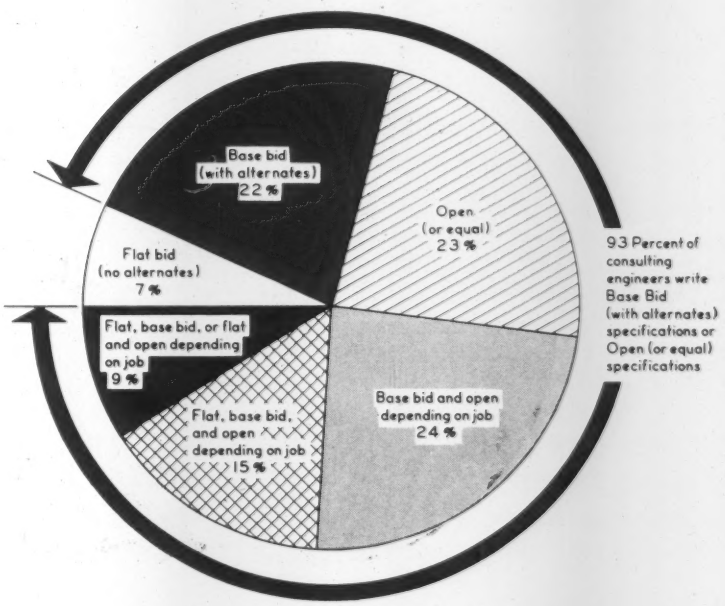
Who in your firm determines whose products will be specified for a job?

What kinds of articles are most helpful or most interesting in magazines that you read?

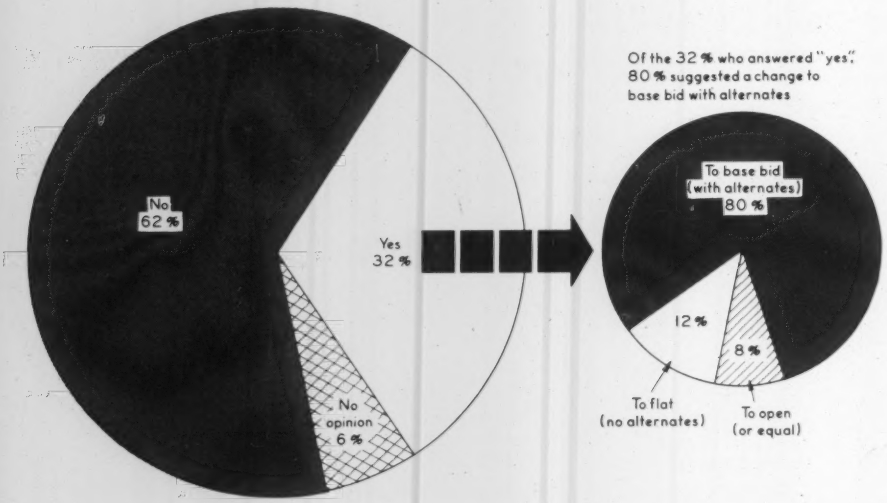
Heating, Piping & Air Conditioning posed these four questions to a cross-section of 300 consulting engineering firms throughout the U.S. The results, representing 41 percent of the firms questioned, are presented on these pages.

What kind of specifications does your firm write?

1) Most consulting engineers (93 percent) write some form of open, alternate, or "or equal" specifications. Only 7 percent of the firms write only flat specifications with no alternates. This, of course, points out the importance of the bidder in the selection of the products that are installed.

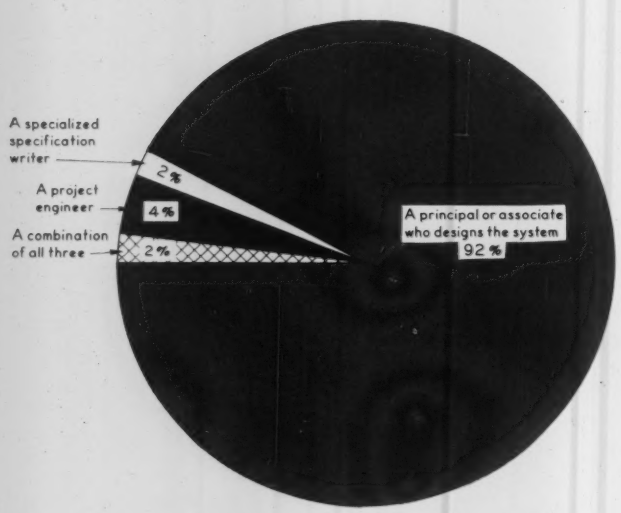

Base bid (with alternates) 22%
Open (or equal) 23%
Flat bid (no alternates) 7%
Flat, base bid, or flat and open depending on job 9%
Flat, base bid, and open depending on job 15%
Base bid and open depending on job 24%
93 Percent of consulting engineers write Base Bid (with alternates) specifications or Open (or equal) specifications

In your experience, is there a change taking place in specifications that is likely to make you change your present practice?



2) There is no change taking place in preparing specifications that calls for major changes in their methods, according to 62 percent of the consulting engineers. Of the 32 percent who feel that a change would be desirable, 80 percent favor the base bid type of specification with alternates. Thus, there is little evidence that there is a trend toward the flat specification.

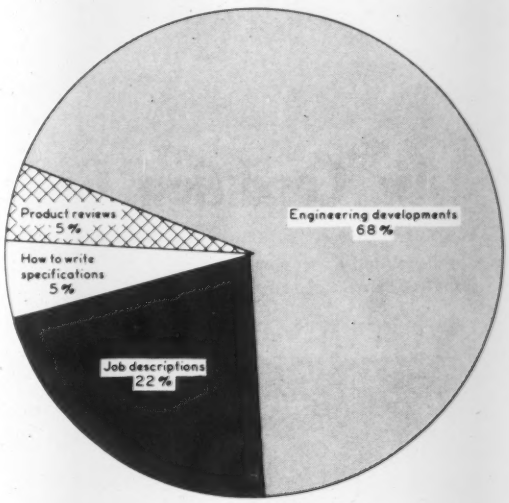
In your firm, who determines whose products will be specified?



3) In 96 percent of the firms, a principal of the firm who designs the system, or a project engineer, determines whose products will be specified. In only 2 percent of the firms does a so-called specification writer have this responsibility, and in another 2 percent it is a combination of all three. This verifies the fact that the engineers who design the systems determine the products that are specified. This authority and responsibility is not delegated.

What kinds of magazine articles are most helpful or most interesting to you?

4) Only 5 percent of the consulting engineers indicated that articles on how to write specifications are of prime importance. Most helpful to consulting engineers are articles on engineering developments (68 percent) and job descriptions (22 percent). Another 5 percent listed product reviews. This is significant because it verifies the viewpoint that consulting engineers are basically interested in engineering developments and in descriptions of how jobs are designed and installed — rather than with the "techniques" of writing specifications. ≠



Air Conditioning Vital To Atomic Sub Cruising

—says Navy scientist

THE RECENT extended underwater cruises of the atomic submarines *Nautilus* and *Seawolf* would not have been possible without air conditioning, according to a U. S. Navy medical officer.

In an interview reported by Carrier Corp., LCdr. John H. Ebersole, (MC) USN, noted the vast difference between the short submerged cruises without air conditioning accomplished by Navy submarines during World War II and after, and the record-setting endurance marks established while he was aboard both *Nautilus* and *Seawolf*. *Seawolf* remained submerged for a period of 60 days.

Dr. Ebersole cited specific difficulties encountered in such missions. During normal submerged operations, a large amount of heat is given off by the reactor, electronic equipment, crewmen, and by cooking and steam leakage. Arctic waters create additional problems, since in such a low temperature environment the chilled metal structure of the vessel can cause moisture to condense on the internal surfaces of the ship, creating a cold, damp atmosphere. In tropical waters, little heat transfer is effected through the hull to the water, and without air conditioning, interior temperatures rise rapidly to unendurable levels.

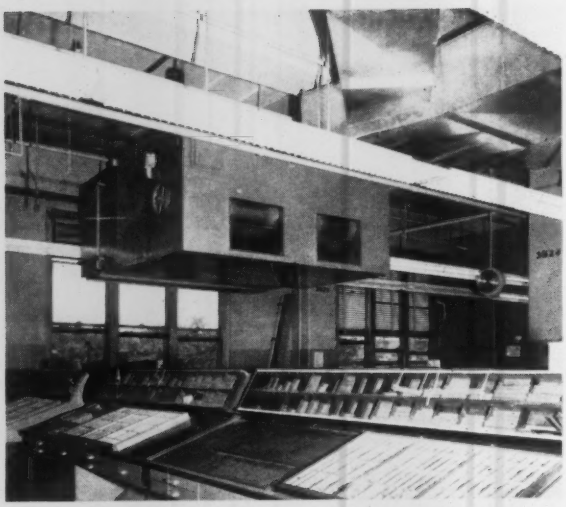
The air conditioned *Nautilus* and *Seawolf* interiors, he said, are maintained at a constant 73 F and at 52 percent RH.

Dr. Ebersole is a consultant to the committee on life sciences of the National Aeronautics and Space Administration, Project Mercury, which will attempt to place a man in space. He noted that valuable information for outer space flights is obtained by observance of life aboard the sealed submarines cruising in "inner space."

Beginning with the attack submarine *Thresher* now under construction, the Navy's undersea vessels, including Polaris-firing subs, will be equipped with absorption-type water chillers, according to Carrier Corp. ≠

NEW AND EXISTING EQUIPMENT COMBINED TO . . .

Air Condition Government Printing Office



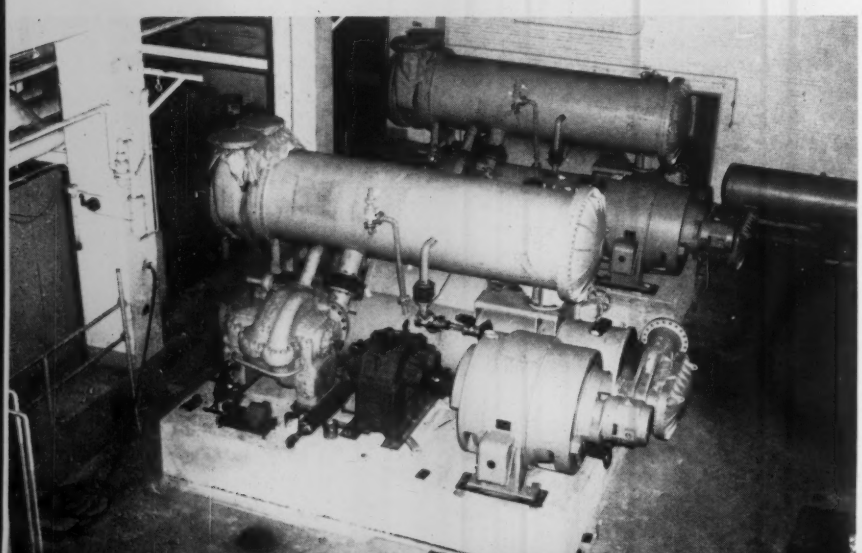
AIR HANDLING UNITS generally are ceiling suspended to conserve floor space. Photo shows unit prior to connection with supply ducts. Units have high velocity cleanable filters

By WILLIAM G. ROBERTSON, JR.
President
and ERNEST MORITZ,
Project Manager
Henry Adams, Inc.
Consulting Engineers

THE U. S. Government Printing Office, the largest noncommercial printing plant in the world, houses approximately 1,327,000 sq ft of air conditioned floor area. This huge facility, located in the nation's capital, comprises three adjacent eight-story buildings and employs upwards of 6200 persons to produce the incredible volume of printed matter needed to run this country.

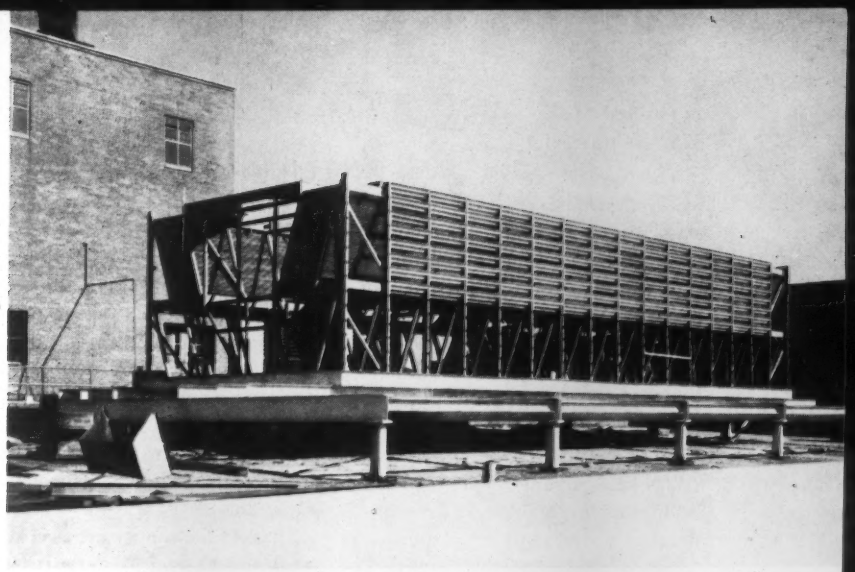
Air conditioning was first introduced at the Printing Office back in 1938 when the third building was constructed. A central system incorporating a 640-ton cooling capacity was installed then to condition the pressrooms of the 600,000 sq ft structure.

Self-contained air conditioning



TWO CENTRIFUGAL CHILLERS with 2025 ton cooling capacity supply chilled water for air conditioning Government Printing Office. Units, shown partly assembled, were installed on bases which are supported by rubber-in-shear isolators mounted directly on floor

Year 'Round



DOUBLE-FLOW COOLING TOWER on roof of building No. 3 pictured above in erection stage. Weight of tower and steel is carried by center supports; stubs at ends of beams act only as braces

units totaling 350 tons' cooling capacity have been added through the years for cooling office spaces and proof rooms of all buildings. There being no master plan for these supplementary installations, they were stop-gap measures only and, in many instances, did not include provision for introducing ventilation air.

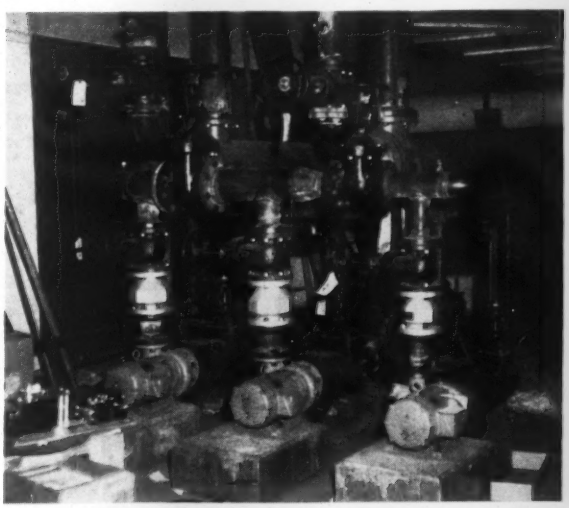
In 1956, air conditioning of all production spaces and enlargement and modernization of the electric power system were authorized. The new air conditioning system was needed to serve approximately 600,000 sq ft, including spaces inadequately served by self-contained units. Revisions to the electrical power system were necessitated by the growth of the electrical load in the building as well as the proposed addition of the air conditioning equipment.

While several schemes were considered for the project, it was decided to do the following:

1) Keep the existing central system in building No. 3.

2) Remove all self-contained units from buildings Nos. 1 and 3 and reinstall them in No. 2.

3) Add new central chilled water and hot water generating plants serving air conditioning units of various sorts for buildings Nos. 1 and 3.



HEAT EXCHANGER-HOT WATER circulating pump installation for a zone shown above. Center pump is standby for either zone pump

• A year 'round air conditioning system has been installed in the U.S. Government Printing Office, Washington. The system will permit close control of temperature and humidity in the massive facility which issues millions of government documents every year. The consulting engineers who designed the system tell how it was done within the budget allowed and without interrupting plant 24-hour operation.

The central system in No. 3 was retained since it is in first-class running condition and replacement was unnecessary. Relocation of all self-contained units to building No. 2 was advantageous because:

1) The building air conditioning load is approximately equal to the total capacity of units on hand.

2) This arrangement required minimum expenditures for condensing water piping and pumps.

3) Maintenance was simplified.

Consider Motors, Pumps

The new chilled water plant consists of two centrifugal chillers totaling 2025 tons of cooling capacity, and the necessary pumps and cooling tower. Chillers are arranged for series flow and feature automatic capacity reduction down to 5 percent of total plant capacity. The compressors are driven by synchronous 4160 volt motors which are started across the line. Synchronous motors with unity power factor were selected to provide correction for the large inductive load with lagging power factor existing in the plant. To this end the motors on the existing compressors were replaced with synchronous units.

To keep from damaging existing waterproofing, the chillers were installed on bases which are supported by rubber-in-shear isolators mounted directly on top of the floor construction. One 3250 gpm pump interlocked with the chiller controls circulates chilled water to all units when the refrigeration compressors are running. A standby chilled water pump is not provided, but a spare pump motor is stocked for quick replacement.

The condensers are arranged for parallel water flow, each chiller being served by one condensing water pump. Piping is valved to permit operation of either condensing water pump with either chiller in case of pump or chiller failure. A double-flow cooling tower is provided on the roof of building No. 3. For fire protection, a rate-of-rise actuated deluge sprinkler system is installed in the tower.

Structural considerations dictated a rather unique arrangement of tower load distribution. Due to existing floor and column loadings, the tower weight could be imposed on one row of columns only. The tower steel was therefore designed to be centered on and supported by these columns, with the ends of the steelwork merely braced to counteract turning moments.

Air handling units, in general, are ceiling suspended in the conditioned spaces to conserve floor space. Areas requiring large air quantities and/or sprayed coils for humidity control have floor mounted built-up units.

Ventilating air quantities are controlled to utilize outdoor air for cooling when possible. Ceiling suspended units feature high velocity cleanable filters, while floor mounted built-up units have multi-duty oil bath filters. Space cleanable filters are furnished to permit replacement while units are running.

Heat, Cool Simultaneously

Because internal heat loads vary greatly, provision for simultaneous heating in one area and cooling in another is necessary. This is accomplished by installation of the hot water heating coil, controlled by a three-way valve, upstream of the chilled water coil which has face and bypass damper control.

The arrangement has the additional advantage of flexibility with respect to future operational requirements, as well as maintenance of a constant chilled water circulation rate and maximum dehumidification whenever the chillers are operating.

To prevent pressure buildup within the conditioned spaces when outdoor air is introduced in large quantity, a system of automatically controlled relief air dampers is provided. These dampers are controlled so that when minimum outdoor air is introduced they remain in the closed position. When ventilation air quantities exceed the minimum, the damper is activated through a differential static pressure regulator which, when pressure in the conditioned space exceeds the outdoor pressure, opens the damper in proportion to the differential.

All air distribution is low pressure. Ducts are generally exposed at ceilings, except for offices where suspended ceilings conceal them. Diffusers are circular or rectangular, as required by the air distribution pattern.

Leave Heating Intact

All buildings have low pressure steam heating, utilizing under-window radiation. For budgetary reasons these systems were retained to account for the peripheral heat loss. Steam piping and control is such that it precluded extensions to the air handling systems.

Each of the three buildings was provided with a new hot water heating system with steam convert-

Well-designed system delivers round-the-clock, year 'round air conditioning — in spite of shortcuts imposed by tight budget

ers and circulating pumps to serve new and relocated air handling equipment. The converters and piping are large enough to carry the entire building and outdoor air load. Provision is made on each floor for the eventual extension of the system to replace the steam radiation.

Converters are exposure zoned and vary hot water supply temperature. This system is designed to control future hot water radiation as well as to maintain reasonably constant circulation through the coils. One standby pump is provided for each group of zone pumps. All are supervised by an electronic alarm system.

Meet Special Requirements

Several requirements and conditions necessitated specialized treatment. In the mono-casting area, a ventilation system introducing high quantities of outdoor air had originally been provided to remove oil and lead vapors rapidly. Maintenance of this ventilation rate with conditioned air would have imposed a prohibitive refrigeration load. Air conditioning alone could at best, however, provide only partial improvement to the environment.

Mono-casting machines are quite noisy and, where not perfectly adjusted, discharge jets of air containing oil vapors and possibly some lead fumes. It was therefore desirable not only to condition the space but to improve working conditions generally. To accomplish this, a suspended ceiling was provided above the machines to act as an exhaust hood as well as to improve the acoustical condition. By lowering the ceiling, the resulting reduction in length of oil and lead vapor travel proved beneficial to the clearing of the atmosphere. Although the ventilation rate was reduced by 50 percent, the effective rate of air circulation was only reduced by about 20 percent.

An existing ventilating supply system with outlets near the floor — a source of complaints due to drafts — was removed and a new air supply system was provided which introduces conditioned air above the working aisles, drawing the air across the machinery and exhausting it through return air inlets in the ceiling between machines.

Since supply air is discharged at and directed to the operating aisles, its temperature is somewhat higher than normal as determined by the operator's comfort rather than ambient room conditions. This results in an appreciable saving in refrigeration load.

The linotype machine areas are conditioned by built-up units. These spaces have very high internal heat loads. However, due to the nature of the operation, spot cooling could not be employed. A type metal melting room adjacent to the linotype machine area has a system which introduces exhaust air from the linotype space or from outdoors. Conditioning of this space in a conventional manner was considered prohibitive in view of excessive internal loads caused by large gas fired lead furnaces as well as storage of cast hot lead bars. This system is controlled through a set of thermostats, one located in the return air from the linotype space, the other in the outdoor air. These thermostats position dampers in such manner as to always introduce the cooler air.

The stereotype room, which contains a large number of metal melting pots, is provided with an air conditioning system introducing all outdoor air. All metal melting pots were provided with exhaust hoods.

The electrotype molding section is served by a spot cooling system directing conditioned air to all operators' locations. Because large exhaust air quantities are required, this space could not be conditioned in a conventional manner.

A complete air conditioning system was installed for the cafeteria and new exhaust hoods put in for all high heat and vapor producing equipment in the cafeteria area and kitchen. Supply ventilation air (not cooled) is introduced to the kitchen and dishwashing area to replace the exhaust air.

Other special systems include a dual-duct installation with individual room temperature control for the executive offices, built-up units with sprayed coil dehumidifiers for year 'round temperature and humidity control of pressrooms, and a ventilating system using building exhaust in the summer and outdoor air in the winter for transformers and switchgear.

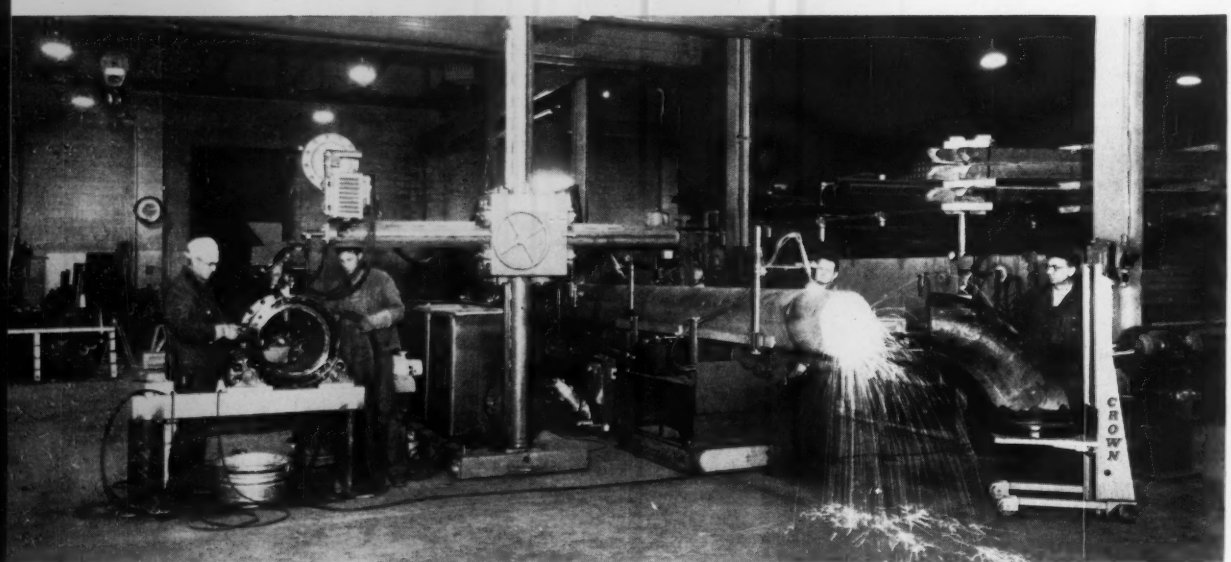
No Plant Interruption

A factor complicating the design and installation of the systems was the necessity of maintaining full plant production during the time that the work was being executed. Since the majority of departments operate on a 24-hour-a-day, six-day-a-week schedule, the installation on an overtime basis was, of course, out of the question.

All work in production spaces was therefore scheduled during normal working hours in such a manner as to interrupt production processes as little as possible. The schedule gave the mechanical contractor the use of limited areas for a specified period to complete those phases of the work interfering with normal operations. By close adherence to this schedule, temporary ventilation, the utilization of movable scaffolding, special protective features, etc., it was possible to complete the job without causing any serious interruptions to the Printing Office operations.

The air conditioning systems were designed by Henry Adams, Inc., consulting engineers; the installation was made by John C. Grimberg Co., Inc., mechanical contractors. ∓

Why?
With What?
How?



COMPACT PRODUCTION "PACKAGE" for automatic welding of large diameter pipe has permitted savings of up to 50 percent at plant of Wray M. Scott Co., Omaha. Central unit shown here is universal fixture or manipulator which mounts automatic submerged arc welding head powered by 750 amp a-c/d-c rectifier unit, carried on movable manipulator platform. Pipe from 8 to 24 in. diameter is carried on automatic turning rolls synchronized with welding head to give desired travel speed on circumferential welds. At extreme right is small hydraulic platform hoist used to fit up 18 in. elbow to 18 in. diameter pipe. Latter is being cut to length and beveled by flame cutting pantograph. Flame cutting mechanical draftsman is used to cut and bevel both ends simultaneously on pipe sizes from 2 to 6 in. diameter. Scott reports that full cost of equipment was amortized in the first 12 months' operation. A significant corollary result has been promulgation of Standard Procedure Specification Number 21 for automatic submerged arc welding of carbon steel pipe, valves, fittings, and flanges by National Certified Pipe Welding Bureau cooperating with Mechanical Contractors Association of America

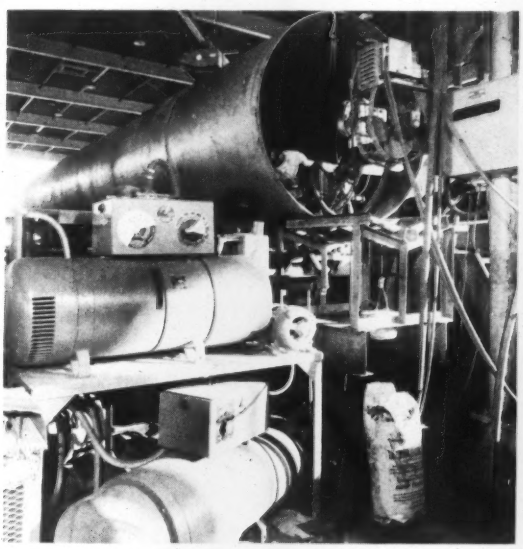
• Shop fabrication of piping with the submerged arc welding process pays off in low labor costs, high weld quality. This was the theme of a talk given by Robert A. Wilson before the pipe welding panel at the recent convention of the Mechanical Contractors Association of America. Mr. Wilson, vice president of Lincoln Electric Co., centered his discussion on fabrication of power piping, but stated that the treatment of the subject and conclusions also encompass low pressure applications. This article is based on his presentation.

REDUCING labor costs and increasing weld quality are the two main reasons for welding pipe automatically. The higher deposition rate of automatic submerged arc welding obtained by raising the welding current permits increased welding speed. This speed increase, usually two to four times that of hand welding, reduces labor cost.

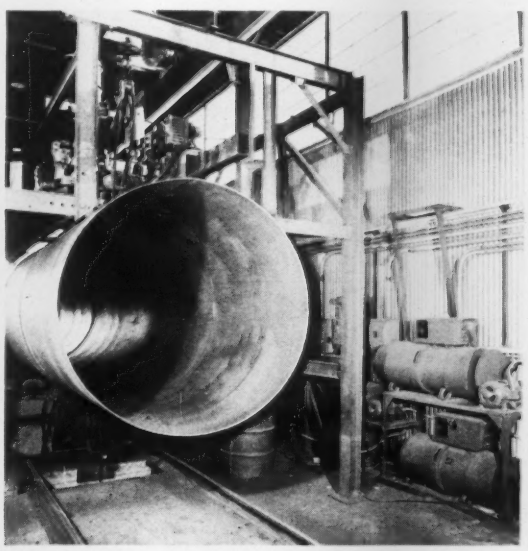
Fewer stops and starts in an automatic weld are directly responsible for improved weld quality. You make one complete revolution and then stop. Heavier welds are run continuously, bead after bead without stopping. In hand welding it is necessary to stop every minute and a half to change electrodes. Each stop and start affords an opportunity for slag to trap or incomplete fusion to develop—both of which have a detrimental effect on weld quality.

Due to the continuous deposition of high quality weld metal, the submerged arc process produces x-ray quality welds. On a high production, properly fixtured application, there is no excuse for not having perfect x-ray performance.

Of the two reasons for automatically welding pow-



FITUP JIG in which 6 ft "cans" are tacked for inside welding of longitudinal and 'roundabout seams shown above. Welding head is mounted on boom. Current is from lower generator, of 750 amp capacity



PIPE SECTION 42 ft long is mounted on special rail car with power driven rollers. Dual tandem head automatic welding arrangement, with submerged arc welding heads traveling rail positioned at about top center for longitudinal seams, welds at speeds of 50 to 90 in. per min

er piping, labor cost is by far the most important. Manual arc welding quality is usually adequate for most applications.

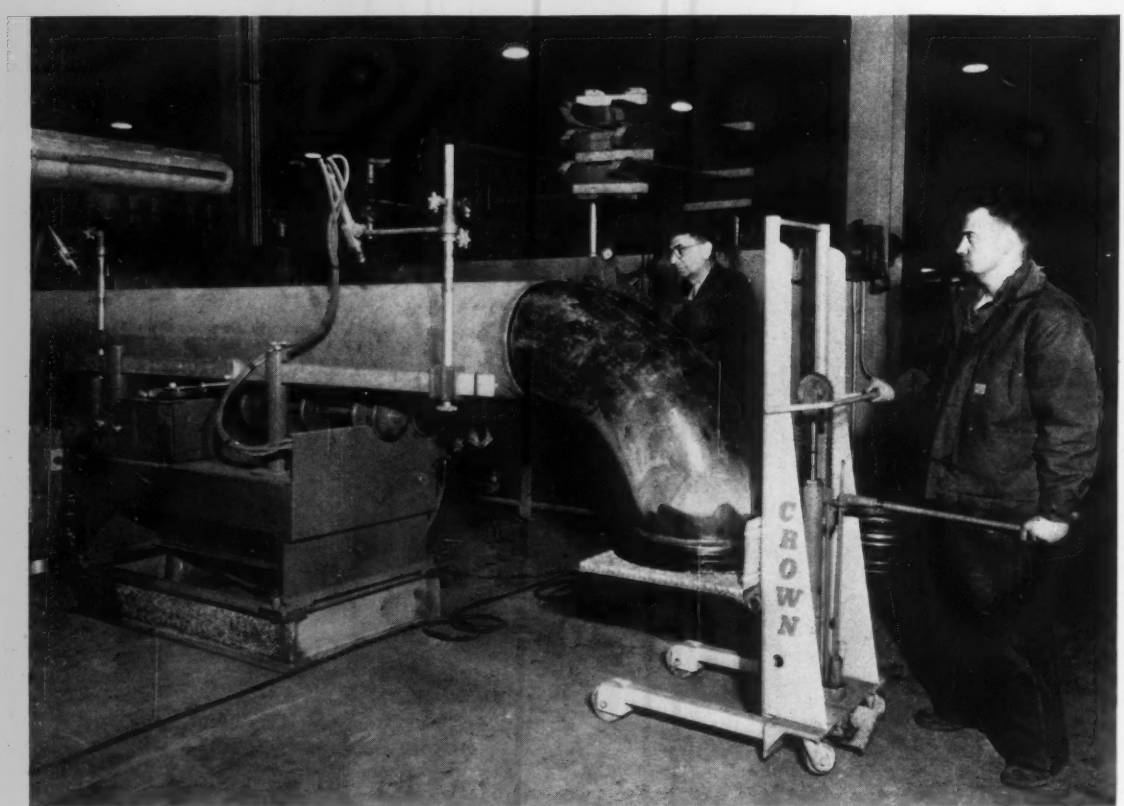
To more clearly appreciate this matter of lower welding costs, lets analyze some of the factors involved. Usually in hand welding, the first pass must be put in with a current of around 125 amperes. As the weld progresses and the groove widens out, it is possible to increase electrode size and current. However, the maximum setting would be about 225 amperes on a 3/16 in. diameter electrode.

With the automatic process, after the first pass is put in manually either with stick electrode or TIG inert gas welding techniques, subsequent passes are put in at currents from 450 to 600 amperes. This increase in current will deposit metal at a rate two to three times that obtainable with hand welding and will reduce the arc time in direct proportion.

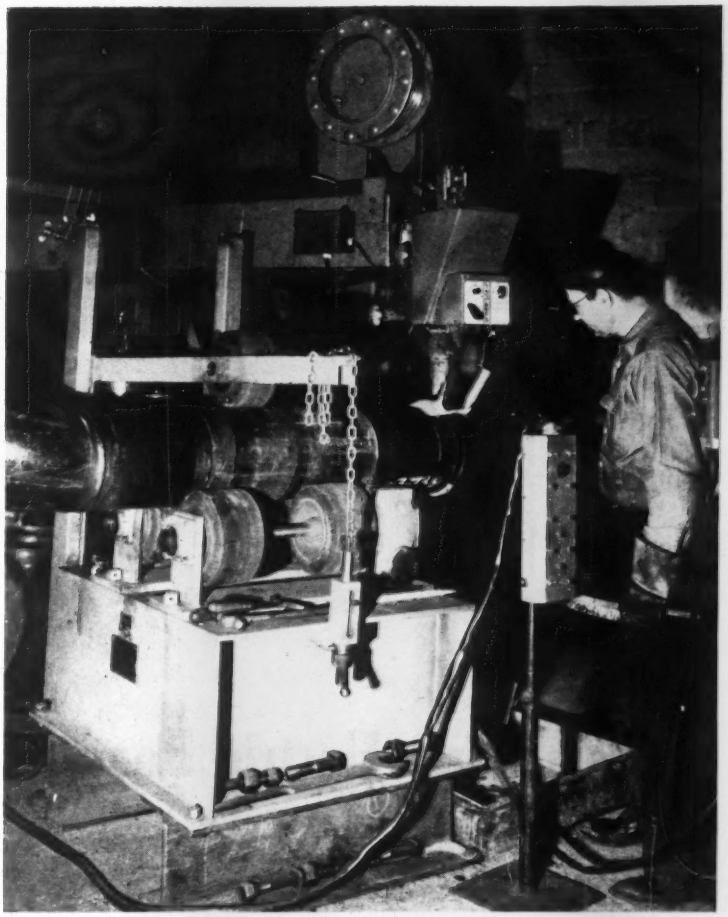
Elimination of much of the cleaning time and time loss for stopping and starting further increases operator efficiency and results in even greater reduction of direct labor time. While the operating factor (the arc time percent of overall time) ranges from 30 to 50 percent for hand welding, the automatic process will usually be 50 to 75 percent.

What Equipment Is Needed?

What equipment is needed for this type of welding? Most applications must be fixtured for automatic operation incorporating the submerged arc process. The submerged arc process involves continuously feeding a mild or alloy steel electrode through a welding head into an arc which is buried under granular flux. The flux completely covers and hides the welding arc and provides a blanket of molten slag which shields the molten metal while it solidifies. Other necessary pieces of apparatus, besides the welding head, will include a motor generator set delivering d-c welding current and a fixture to position, rotate, and support the pipe so that welding can be performed in the proper position.



AUTOMATIC SUBMERGED arc welding head is carried on horizontal boom travelling vertical post on universal manipulator which can be seen at right center. Manipulation is mounted on movable platform which also carries 750 amp d-c power supply unit. Welding head here is positioned over work on table in foreground. It is swung around 180 deg for operations on pipe such as 18 in. diameter length in background, set on automatic turning rolls synchronized to give proper travel speed for a circumferential weld. Equipment also can be adapted to fitting up elbows and tees, with aid of small hydraulic platform hoist which raises fitting into place over backing ring inserted into prepared end of pipe. Work then is slid along turning rolls to permit automatic welding



PIPE ROTATOR for constant speed rotation of large pipe or cylinders to 36 in. diameters. Load capacity is up to 5000 lb. Separate stand idler is available for long pipe sections

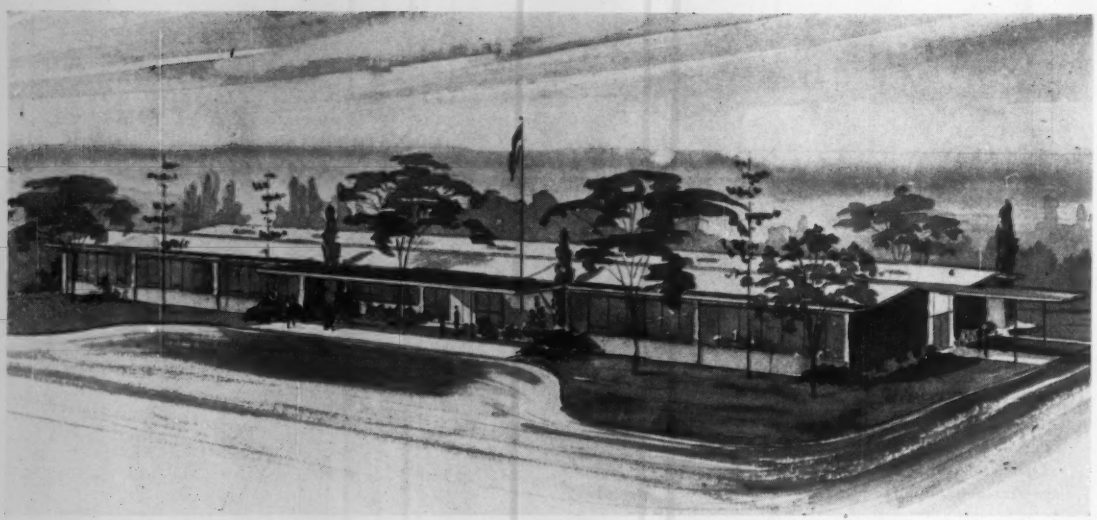
Recently, some new pipe welding processes have been introduced which hold great promise, but they have not yet proved completely practical for all aspects of pipe welding. Inert gas shielding and inert gas flux shielding processes have both seen successful use on specific applications. Another recent development involves an entirely new process in which all the flux ingredients are included in the core of a tube rod. These ingredients produce a metallic vapor shield that eliminates the need for a shielding gas or flux. No doubt areas will be found where these new processes will be used to advantage. But at the present time, welds produced with the automatic submerged arc process are still the most practical and economical to produce.

How Are Joints Prepared?

What is involved in joint preparation? What procedures are used? There are two general methods of preparing the pipe welding joint. The easiest uses a permanent steel backup ring. Highest operator productivity is achieved with this joint preparation, since all passes are deposited with the automatic process.

If permanent steel backup rings cannot be used due to application restrictions, the alternate procedure has the first bead deposited by hand with either low hydrogen Type E-6010 or with the inert gas TIG process using a filler metal of the same analysis as the pipe. After putting the first pass in manually, all subsequent welding can be done with the automatic process.

The minimum pipe diameter that is easily welded with the automatic process is around 6 in. But 3 or 4 in. diameters can be successfully welded if production justifies the investment needed for the necessary fixturing. Where application restrictions prohibit use of backup rings on ¼ in. wall and lighter pipe, hand welding the entire joint is more economical. Any gain in speed by using automatic welding on the second pass would be lost in setup time. In general, joint preparations used for hand welding are used for the automatic process, especially when the first pass is to be put in by hand. ±



Economical Heating for this new school was achieved by . . .

Combining Electric Heating Coils With Gas-Fired Warm Air Perimeter System

By JOSEPH B. OLIVIERI
J. B. Olivieri & Associates
Consulting Engineers

A LOT has been written pro and con about electric resistance heating. In areas with severe heating requirements and nonsubsidized electric rates, it is difficult to justify electric heating. However, if electric power is used in conjunction with fossil fuels, a very favorable owning and operating cost can be achieved.

In an attempt to find a logical answer to heating and ventilating schools with this combination, experimental use has been made of warm air heating systems.

Our studies have shown that, if an inexpensive set of reheat coils could be found, one duct system could be used, and it would not be necessary to modify the furnace. Use of electric resistance blast heating coils has proven to be low in first cost and to provide a small enough operating cost that the total system owning and operating costs are the lowest known to the author.

Use Heaters 40 Hours a Week

The low first cost of electric resistance heaters is obvious. But the proof of their acceptable operating cost is not. A careful analysis of heating requirements will show that a classroom is used some 40 hours a week. Therefore, for 40 hours a week, full heating must be supplied, and for the remaining 128 hours, only reduced heating is required. The 40 hours that full heating is required is the only time that the electric heating is used. A room thermostat maintains desired nighttime temperatures by controlling the warm air furnace in a conventional manner.

Warm air is delivered in sufficient quantity to offset the heat loss of the classroom. The electric reheat coils serve only to supply enough heat to maintain temperatures desired above 72 F.

To arrive at a realistic analysis of seasonal fuel cost for a typical classroom, assume the average heating requirement for each 24 hours from October through April to be 17,000 Btu per hr. This has been computed

• School classrooms, occupied only about 40 hours a week throughout the school year, can be heated and ventilated at low owning and operating costs through a combination of warm air heating and electric resistance heaters, says the author. In this article he computes these costs and reports how a system of this type was designed for a first cost of $1.25 per sq ft.

using an average outdoor temperature of 35 F and an inside temperature of 72 F for 8 hours per day and 60 F for 16 hours per day. The cost for gas for the schoolroom would be:

(17,000 Btu per hr × 24 hr × 213 days) /1000 Btu per cu ft = 115,000 cu ft of gas per year × $1.00 per 1000 cu ft = $115 per year per classroom.

For an average sized classroom of 900 sq ft, the cost of gas for heating would be $0.128 per sq ft per yr.

In calculating the cost of electric power operating the reheat coils, assume that, on the average, the room temperature requirement will be 74 F. To raise 800 cfm 2 F requires 500 watts. Therefore:

500 watts × 40 hr per wk × 30 wk = 600 kwhr × $0.025 per kwhr = $15.00 per season per classroom, or $0.016 per sq ft of classroom.

Figure Owning, Operating Costs

To get a true picture, it is necessary to calculate owning and operating costs. The first cost of this system will be $1.00 per sq ft, or, if amortized at 5 percent interest for 20 yrs, the cost is $0.08 per sq ft per yr. This gives an owning and operating cost of $0.224 per sq ft per yr. Table 1 gives a comparison of owning and operating costs of this type of system and those for a zoned-furnace system.

TABLE 1 — OWNING, OPERATING COSTS for two school heating and ventilating systems are compared below

System	First cost, $ per sq ft	Amortize $ per sq ft per yr.	Operating $ per sq ft per yr	Owning and operating costs, $ per sq ft per yr
Furnace with electric reheat	1.00	0.08	0.144	0.224
Zoned furnace system	1.20	0.096	0.128	0.224

The system used in the installations designed by our firm is a warm air perimeter system with the ducts embedded in the concrete slab around the perimeter of the building. Air is introduced into the room through a continuous supply outlet incorporated into a wall-to-wall bookcase. Also incorporated into the bookcase is the electric reheat coil and balancing damper.

An additional advantage of this system is that no special provisions need be made for future air conditioning. When air conditioning is desired it is only necessary to add a cooling coil and the mechanical refrigeration equipment.

The application of this system is, of course, not limited to schools. It can be used in churches, office buildings, and similar structures.

System Meets Limited Budget

School heating systems today must provide heating, ventilation, and individual room control. This is relatively easy to do today if one has a liberal budget. In the case of a rural school in northern Michigan, it was necessary to provide the above for $1.25 per sq ft. Through the use of a warm air furnace and electric reheat coils in the duct system, the school's heating needs have been satisfied within the limits of this budget.

Another reason for the selection of this system was its ease of maintenance. As the school is located several hundred miles from the nearest service center, it was important to design a system that local people could maintain and service. ∓

Can We Simplify Mathematics?

That's what the Chicago Committee for the Simplification of Mathematics is trying to find out. Here's an explanation of its objective, together with highlights of the "Aeberly Method"

By Charles R. Kuglin
Partner
Childs & Smith
Architects and Engineers
and C. M. Burnam Jr.
Editorial Director
Heating, Piping & Air Conditioning

WHILE WE BOTH managed to get our college credits in calculus courses without too much trouble, we've never felt really at home in that branch of mathematics. It is thus a surprise to us to be serving as members of the Chicago Committee for the Simplification of Mathematics.

This voluntary, civic-minded committee — says its letter-head — is dedicated to the improvement of our educational processes through the simplification of mathematics. So perhaps our calculus difficulties during our school years are all the more reason for us to cooperate in helping to achieve the objective of this committee.

What bothers us is that all the other committee members seem to know a lot more about what the group is talking about at its meetings than we do. That's the reason for this article. We'd like to tell you a little about the committee, other organizations that are interested in its work, and how it hopes to "simplify mathematics." Most importantly, we'd like your advice and comment. Is the committee's objective an important one, in your opinion? Is it going at the problem in a sensible way? How should the committee go about furthering its objective?

The general chairman of the committee is Ralph J. Abramson, of Abramson & Klipp, consulting engineers. Henry J. Couch — executive secretary of the Ventilating & Air Conditioning Contractors Association of Chicago — is the committee's executive director. Rudolph J. Houkal, Jr., chief mechanical engineer, Perkins & Will, architects and engineers; E. C. Varnum, Barber-Colman Co., and the authors of the present article are committee members.

Organizations supporting the committee's work (by resolutions commending the importance of its objective, by reviewing its work, and in other ways) include the Chicago Association of Consulting Engineers, the Chicago chapter of the American Institute of Architects, the Building Construction Employers Association, the Mechanical Contractors Chicago Association, the Ventilating & Air Conditioning Contractors Association of Chicago, the Plumbing Contractors Association of Chicago, and the Electrical Contractors Association of Chicago.

We have recited these names of committee members and of organizations interested in the committee's work to indicate not only that this question of simplifying mathematics is of importance, but that it is particularly of very practical importance to architects, engineers and contractors in the building construction field.

'Here Comes John Aeberly'

So far, we haven't mentioned the committee's most important member as well as its mathematical advisor — John J. Aeberly, chief of the Bureau of Heating, Ventilation and Industrial Sanitation of the city of Chicago for 35 years, ventilation engineer with the city's Board of Health for eight years previous to his present post, two years before that as a cost analyst in the city's Bureau of Engineering. He has bachelor's and master's degrees in engineering from Armour Institute of Technology (now Illinois Institute of Technology), and has done post-graduate work in mathematical research. He is the author of numerous articles and papers on ventilation and industrial health, and on the simplification of mathematics.

Mathematics is very much his hobby. We doubt that even a higher mathematician could determine with any accuracy the number of evening and week-end hours that John has devoted to this subject in recent years. For awhile, it was just about impossible to attend a meeting on ventilation, air conditioning, or heating around Chicago without hearing the warning, "Here comes John Aeberly again with simplified calculus." Many a conversation on ventilation codes, balancing air distribution systems, or some other subject has been broken up by John's equations.

But as he button-holed everyone in sight with his arguments for simplifying mathematics, more and more of his engineer, architect and contractor friends became interested. As a result, a committee was formed to promote the development and acceptance of "The Aeberly Method."

What's the 'Aeberly Method'?

We are indebted to Henry J. Couch, executive director of the committee, for the following explanation of some of the highlights of the Aeberly Method:

"The Aeberly Method for the simplification of mathematics cannot be simply expressed in non-mathematical symbols any more than the Einstein Theory, which is actually a simplification of certain physical laws, can be explained without resorting to equations expressing the relationship between matter and energy.

"Some facts, however, can be stated in ordinary language, and this I shall here attempt to accomplish.

"The Aeberly Method concerns itself at some length with the distinction between the number system, which is 'pure' mathematics, and the everyday use of numbers in the field of economics, the physical sciences, electricity and all of the other common uses with which we are all familiar. This is known as 'applied' mathematics.

"During the long history of the development of mathematics — which was slow, cumbersome and not at all orderly — a number of 'expediencies' were employed and after repeated use, these expediencies have assumed the status of reality. The result of this has been confusion in the minds of students, and in some cases, even in the minds of professors of mathematics.

"One of these expediencies is the use of the equality symbol (=) between two sides of an equation which in reality are *not* equal.

"Another result of this lack of distinction between pure and applied mathematics has to do with the use of the symbols for addition (+) and subtraction (−). These are in the realm of pure mathematics, and they represent mental operations which are real and specific. Addition is addition and subtraction is subtraction.

"These same symbols (+ and −) are used in another sense, over and above addition and subtraction, in applied mathematics, namely as *signs of direction*. These occur whenever a system of rectilinear coordinates is introduced, and the negative sign (−) appears in the second, third and fourth quadrants.

"The confusion resulting from this lack of distinction has produced such strange devices as the square root of minus one. This is something like talking about the corners of a circle. An attempt to explain the square root of minus one would of itself be sufficient to drive a potentially outstanding mathematics undergraduate to major in history or home economics, and to desert the field of science where his talents are so desperately needed.

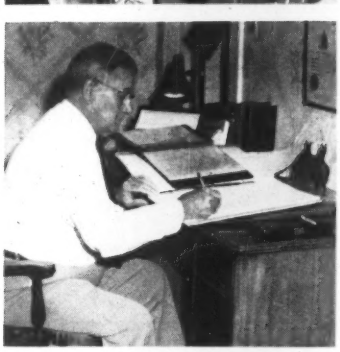
"Another expediency which is taught in schools all over the country has to do with the approach to zero, which is at the heart of calculus. A student is told that he can approach zero 'as close as he chooses,' without specifying how close, and with the added warning that he can never go all the way to zero. This is rather difficult to reconcile with the one science which proudly identifies itself as an 'exact' science.

"The approach to infinity is surrounded with another cloud of uncertainty and ambiguity. The very concept of infinity is bad enough without making it worse. Yet this is what has been done and it is little wonder that we read 'Johnny hates mathematics.'

"There is a great deal more to the Aeberly Method than the few basic points I've tried herein to describe. To develop them, however, would necessitate the use of technical terms and expressions which are beyond the intended scope here. All I have attempted to do is to give some broad answers to the question often heard by the committee, 'What is the Aeberly Method all about?'

"If you are interested in a more detailed description of the Aeberly Method, in more concise terms, the editor of Heating, Piping & Air Conditioning would be more than glad to hear from you, I know."

EVEN A higher mathematician would find it difficult to compute the hours of evening and week-end time John Aeberly has spent developing his method



The Next Step

What the committee would like to do is to get support for a thorough evaluation of the Aeberly Method, and for further development of it, in the mathematics department of some well-recognized college or university. It is hoped, too, that a determination can be made of how successfully it can simplify the teaching of mathematics under actual classroom conditions.

What is needed is a grant or other financial support for one or two graduate mathematics students who are interested in the problem and an evaluation of the Aeberly Method.

Don't Forget Velocity Pressures In Air Handling System Design

• Sometimes engineers fail to consider the relationships between velocity pressure and static pressure when designing air handling systems. The unfortunate result of this might be a wrong fan selection. The table at the end of this article lets you determine these important velocity pressures without the need for a lot of calculation.

By GORDON W. NEAL
Mechanical Design Engineer
Consoer, Townsend and Associates
Consulting Engineers

IN ANY low pressure (under 1 psi) air handling system an important component of the energy possessed by the air in motion is velocity pressure. Velocity pressure represents the unit energy required to create the air movement; it is a measure of the kinetic energy possessed by the air as distinguished from static pressure, which is a measure of potential energy.

The general expression for velocity pressure in feet of the fluid in motion is $V^2/2g$, in which V represents the velocity in fps, and g is the acceleration of gravity in fps^2. Using v as the air velocity in fpm and P_v as the velocity pressure in in. water gage as normally represented in ventilating practice, and using air at the standard conditions of 70 F and 29.92 in. Hg, we find that the foregoing expression reduces to

$$P_v = (v/4005)^2$$

It can therefore be seen that velocity pressure at standard conditions is purely a function of air velocity.

Velocity pressure is used extensively in solving air handling problems. Several examples of its use are:

1) Dynamic losses, such as those occurring at elbows, entrances, etc., are often expressed as percentages of the velocity pressure in the duct.

2) When points in a system have differing velocities, the resulting changes in velocity pressure are reflected as opposite changes in static pressure, although the efficiency of transformation is always lower than 100 percent. This relationship is useful in the determination of the amount of static regain resulting from a reduction in velocity in an expanding duct section.

3) The static pressure against which a fan must operate is expressed by

$$P_s = P_1 + P_{vg} - P_{vf}$$

where:

P_s = static pressure required at fan
P_1 = friction and dynamic losses in system
P_{vg} = velocity pressure at point of discharge to atmosphere
P_{vf} = velocity pressure at fan outlet.

P_{vf} is often eliminated from the expression in order to provide a factor of safety; however, P_{vg} still remains as a component. Furthermore, it is often useful to know the value of P_{vf} in order to ascertain the amount which has been allowed for safety.

4) The total pressure against which a fan must operate is expressed by

$$P_t = P_s + P_{vf}$$

where:

P_t = total pressure required at fan.

Fan total pressure is useful in determining the fan power requirements.

The following table has been prepared to furnish a method whereby velocity pressures at standard conditions can be determined without the necessity of calculations. Since most ventilating problems require precision lower than that provided by the table, the determination of intermediate values will seldom be required.

v = air velocity, fpm
P_v = velocity pressure, in. WG, at 70 F and at standard barometric conditions of 29.92 in. Hg

v	P_v	v	P_v	v	P_v
100	0.001	1900	0.225	3700	0.853
200	0.002	2000	0.249	3800	0.900
300	0.006	2100	0.274	3900	0.948
400	0.010	2200	0.302	4000	0.997
500	0.016	2300	0.328	4100	1.047
600	0.022	2400	0.359	4200	1.100
700	0.031	2500	0.390	4300	1.153
800	0.040	2600	0.421	4400	1.207
900	0.050	2700	0.454	4500	1.262
1000	0.062	2800	0.489	4600	1.319
1100	0.075	2900	0.524	4700	1.377
1200	0.090	3000	0.561	4800	1.436
1300	0.105	3100	0.599	4900	1.497
1400	0.122	3200	0.638	5000	1.559
1500	0.140	3300	0.679	5100	1.621
1600	0.160	3400	0.721	5200	1.686
1700	0.180	3500	0.764	5300	1.751
1800	0.202	3600	0.808	5400	1.818

How to Determine Air Flow Through Quarter-Cylinder Exhaust Hoods

By CLYDE F. METZLER
Chief Engineer
National Technical and Scientific Co.

DATA SHEETS in the June and July issues featured nomographs which permit quick determination of air flow rates for exhaust hoods of various designs. Another type of hood for which this information can be computed very easily is the quarter-cylinder exhaust hood. Simply use the nomograph on the next page. All you have to know are the dimensions of the hood and the average air velocity. Here are a couple of examples of how to use it:

Example 1:

Problem: What is the air quantity entering the quarter-cylinder hood shown on the nomograph if $X = 5$ ft, $L = 10$ ft, and the average air velocity = 50 fpm?

Solution: Enter the chart on the left at $X = 5$ ft and draw a straight line (1) through $L = 10$ ft on the right. From the intersection with the pivot, draw another straight line (2) through air velocity 50 fpm on the left. At the intersection with the central scale, read the air flow as 4000 cfm.

Example 2:

Problem: How much air is being exhausted by a quarter-cylinder hood whose dimensions are $X = 2$ ft and $L = 6$ ft if it is handling air at an average velocity of 100 fpm?

Solution: Draw a straight line from $X = 2$ ft through $L = 6$ ft. From the intersection with the pivot, draw a line through 100 fpm. At the point where this line intersects the central scale, read the air flow as 1920 cfm.

This chart is based on:

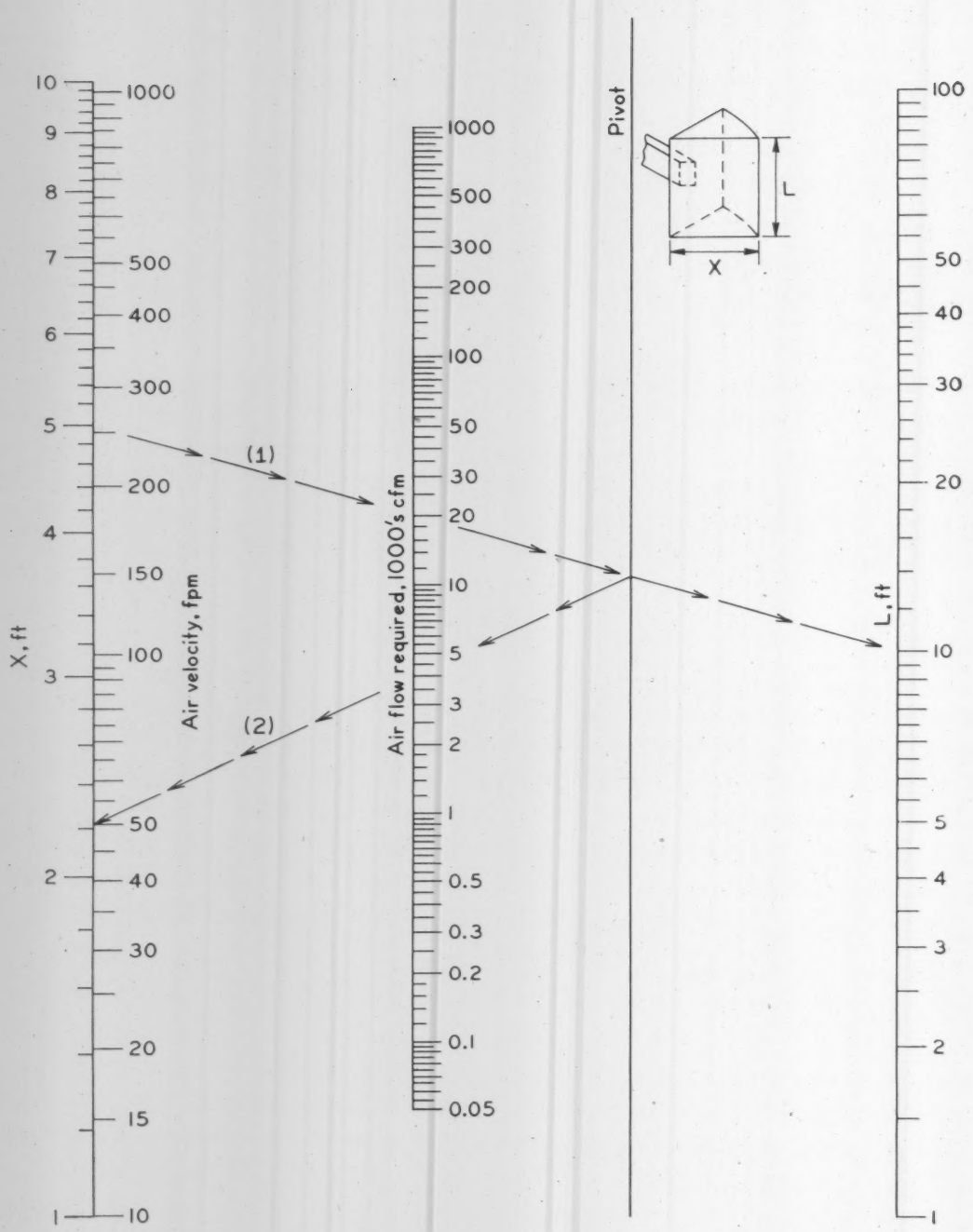
$$F = 1.6\ XLV$$

where:

F = exhaust flow, cfm
X and L = hood dimensions, ft, as shown on nomograph
V = air velocity, fpm.

The nomograph can be used for any hood having the general shape shown.

HPAC DATA SHEET



AIR FLOW RATES through quarter-cylinder exhaust hoods can be determined very quickly and easily using this nomograph. See preceding page for instructions. Lines (1) and (2) plot Example 1 given on page 123. Sketch shown above is of typical quarter-cylinder hood showing all pertinent dimensions

NDHA Looks Ahead To Second Half-Century

- *Customers, steam sales, revenue up*
- *Invested capital and facilities increase*
- *Unit revenue levels*
- *Fuel cost slightly higher*

By JOHN F. COLLINS, JR.
Secretary-Treasurer
National District Heating Association

THE RECENT four-day annual meeting of the National District Heating Association at Grove Park Inn, Asheville, N. C., marked the end of the 51st year of the organization's existence. Those who were on hand said it was a very successful gathering of men in various phases of the district heating industry.

The meeting included six technical committee planning meetings, seven informal breakfast sessions at which problems were discussed person to person, and five half-day technical sessions at which four operating and 10 technical committee reports were presented. The latter included 27 papers and one panel discussion on design, construction, operation, and maintenance of district steam systems.

In his opening address at the first technical session, NDHA President George F. Prestwich, Philadelphia, recommended that the industry increase its efforts to be more successful.

"Our product, in the last analysis," he said "is heat, and this must produce an income which justifies the existence of our systems. Here, we run into the problem of rates. To produce the necessary income, the increasing of rates is quite effective. However, this method many times produces adverse results in the way of losing customers. This can be a vicious cycle which ultimately results in a disastrous end.

"On the other side, reducing expenses will produce the desired results, and should be prosecuted to its limit. In this period of rising costs it is difficult to maintain the line. But I know that all are doing their utmost to accomplish this end.

"The third avenue to success lies in building up the load on the existing equipment which can be operated without increases in personnel. This has been the intended course of many companies which have increased their sales, not only through the medium of additional customers but by additional applications. Notable among these is steam air conditioning, whose application not only creates more load but locates it during the off-peak periods, thereby bettering the load factor," Mr. Prestwich stated.

John F. Collins, Jr., association secretary-treasurer, said in his detailed report on NDHA activities that the organization is moving ahead normally and that its financial position continues to improve. An up-to-date survey of the localities having the service has been undertaken. It should be useful to everyone.

Membership Chairman Henry W. Angelery, president of Aerco

Committees' reports reflect continued growth

Corp., Northvale, N. J., reported that in 1959 NDHA membership had increased from 527 to 540 and in 1960 to date to 560. Included in the new members are two additional heating utilities. Twenty-seven institutions of higher learning operating campus heating plants are now in the totals.

Industrywide Improvements

The statistics committee through its longtime chairman, Foster L. Stephens, steam heating engineer of the Allegheny County Steam Heating Co., Pittsburgh, analyzed important changes in industry factors. He said that in a year (1959), with 0.3 percent less degree-days than the year before, the 58 district steam utilities reporting had sold 1.8 percent more steam. This he attributed to an increase of 2.8 percent in space heated.

He said that the decrease in steam lost of 1.2 percent probably was the result of fewer customers (0.9 percent) and more efficient operation, as there was an increase in distribution system piping over 1958.

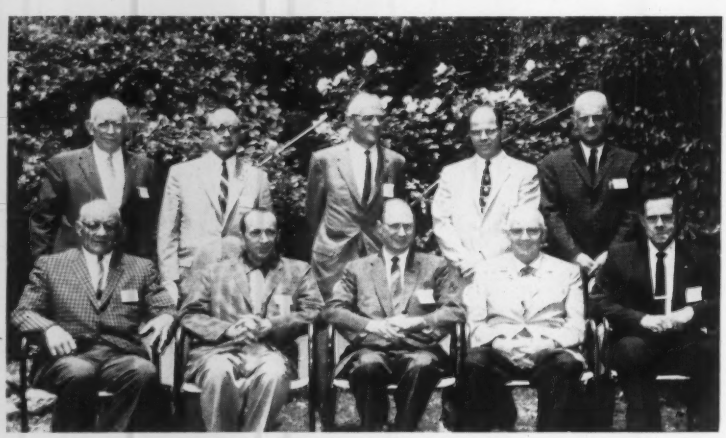
His report showed no appreciable change in average gross revenue of $1.45 per M lb of steam sold, although the cost of coal had risen 0.8 percent per Btu. The company with the highest gross revenue reported it was $2.33 per M lb of steam sold and the one with the lowest reported a similar figure of $0.732, indicating a wide variation in conditions within the industry.

Mr. Stephens reported an increase in invested capital in the industry of 3.9 percent, with corresponding increases in spare boiler capacity of 1.7 percent and in steam line length of 0.5 percent.

The utility with the greatest annual sales in 1959 sold 18,783,614 M lb of steam to its 2355 customers. It had a capital investment of $78.9 million and operated 51 miles of steam piping. The one with the least sales sold 31,543 M lb to 146 customers. It had 1.3 miles of steam line and a capital investment of $148,000.

The highest load factor in the industry in 1959 was 49.9 and the lowest, 16.7.

The 1960-61 NDHA Executive Board



Left to right, seated: Third Vice President Frank C. Meyer, Boston; First Vice President John D. Lemon, Indianapolis; President Albert F. Metzger, Pittsburgh; Past President George F. Prestwich, Philadelphia; Second Vice President James C. Thompson, Atlanta. Left to right, standing: Secretary-Treasurer John F. Collins, Jr., Pittsburgh; Director Homer A. Lawrence, Cleveland; Director Ernest T. Smith, St. Clair Shores, Mich.; Director Donald H. Brandt, Jackson, Mich.; Director Robert H. Swoyer, Allentown, Pa. Absent were James W. Heaton, Philadelphia; and Andrew M. Ritter, Chicago — both directors-elect

More Customers

Sales trends were described in the report of the sales development committee, prepared by William C. Kaber, industrial engineer of the Union Electric Co., St. Louis.

The record shows that, in 34 of the 49 utilities reporting, 275 new customers had been added. It was estimated that these would require 2,779,000 M lb per year and would bring the utilities an added income of $3,238,179 at the estimated rate of $1.17 per M lb.

The number of new customers sold in 1959 was a decrease over 1958. In fact, it is the smallest number for the 15-year period during which the record is available.

The amount of steam sold decreased 5 percent and the revenue decreased 19 percent over 1958. However, the total steam sold and revenue for the year was next to the largest for any of the 15 years.

Ten percent of the new customers gained were returning to the use of district steam after having tried other heat sources for a period; 50 percent were in old buildings, but had never previously had the service, and 40 percent were in new buildings.

In addition, 117 existing customers in 21 cities added more load that is expected to bring in $648,152 in revenue, or 20 percent of their total.

In 19 cities, 71 customers discontinued steam service. A total

of 40, or 56 percent, of these converted to gas, the others to coal and oil. The loss in revenue to the steam utilities was $221,343 for 1959. The number lost was an increase of 42 percent over 1958, but the customers were much smaller since the revenue lost decreased only about ½ percent.

Mr. Kaber reported that 37 cities have adequate boiler capacity to add new customers; six cities do not. In two of these cities lacking capacity, additions are being considered. In six other cities a limited number of new customers can be added.

Steam generating capacity was increased in three cities during the year and additions are being considered in four cities in 1960.

Mr. Kaber said that distribution systems are adequate to take on new customers in 38 cities, and are inadequate in one locality. The facilities are limited in 10 others. Five miles of distribution lines were installed in 1959.

Few Steam Rate Increases

Clifford O. Thurlow, rate consultant for Commonwealth Services, Inc., Jackson, Mich., and chairman of the NDHA rates and regulations committee, reported on rate changes in 89 communities for the 12-month period ending January 1, 1960.

He said that basic steam rates had been increased in eight locations compared with 15 in the previous year. The increases provided by the revisions to basic rates and fuel clauses in seven cities were estimated to vary from a low of 4.2 percent to a high of 34.0 percent (with one utility not providing an estimate).

There were no decreases, but one utility added a new rate for year 'round service, providing an estimated net decrease of 3 percent. Elsewhere, rates remained as in the previous year.

Elect New Officers

At the fifth and final session of the annual meeting, Albert F. Metzger, supervisor of steam utilization, Allegheny County Steam Heating Co., was inducted as the 51st president of the association, succeeding Mr. Prestwich. John D. Lemon, assistant treasurer, Indianapolis Power & Light Co., was named first vice president. James C. Thompson, assistant to the president, Atlanta branch, Georgia Power Co., was elected second vice president. Frank C. Meyer, head of the steam sales division, Boston Edison Co., was chosen third vice president.

Three new directors are elected annually to two-year terms. This year they are James W. Heaton, assistant manager, industrial sales division, Philadelphia Electric Co.; Homer A. Lawrence, commercial sales manager, Cleveland Electric Illuminating Co.; and Andrew M. Ritter, district manager, Yarnall-Waring Co.

The five other directors who remain in office are Past President George F. Prestwich, superintendent, coal bureau and steam heating division, Philadelphia Electric Co.; NDHA Secretary-Treasurer John F. Collins, Jr.; Donald H. Brandt, general steam heating supervisor, Consumers Power Co., Jackson, Mich.; Ernest T. Smith, technical supervisor, Gilsulate Div., American Gilsonite Co.; and Robert H. Swoyer, mechanical research engineer, Pennsylvania Power & Light Co., Allentown.

The 1961 annual meeting of the association will take place at Wentworth By-the-Sea, Portsmouth, N. H., on June 12 to 15.

Reports of the technical papers presented at this year's meeting will appear in future issues. ±

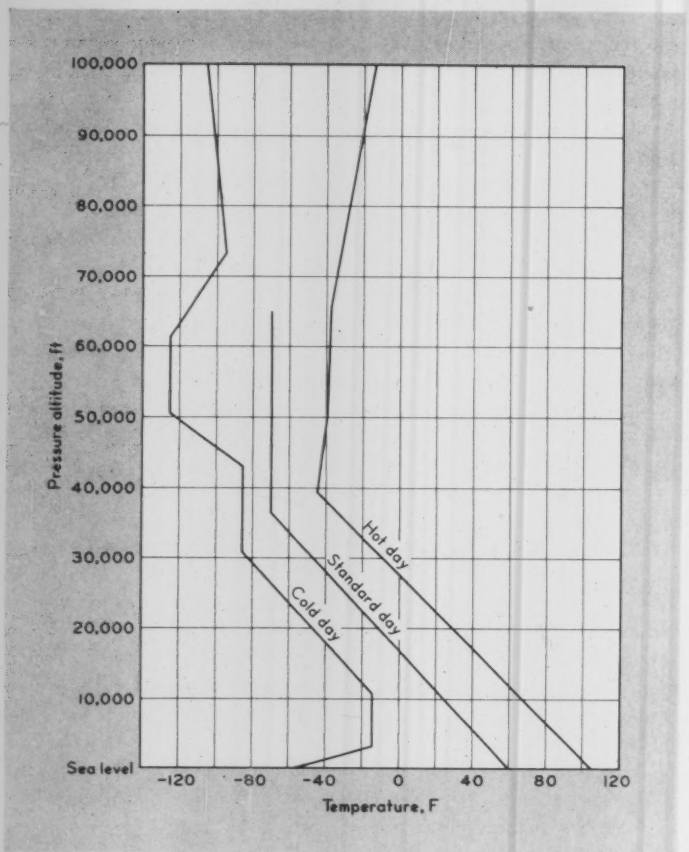
Pushbuttons Will Regulate New Building's Climate

THE Prudential Insurance Co.'s new 24-story Plaza building in Newark, N. J., now nearing completion, will utilize the largest central automatic control installation in any New Jersey office building, according to Minneapolis-Honeywell Regulator Co.

The building is equipped with chilled water cooling and steam-hot water heating systems, which will be controlled from panels located in the second basement. An engineer at this location will be able to read the temperature at some 140 check points throughout the system, and to regulate the equipment controlling temperature and relative humidity in the building.

The system involves approximately 2000 pneumatic and electronic temperature sensing devices, motors ranging from ½ to 900 hp, and almost 5000 wire connections to the control panel. Check points are located outdoors on the four sides of the building, in ducts before and after heating and cooling coils, in hot and cold water piping and on all floors.

Both bellows-capillary tube and thermo-electric temperature control devices are used in the system. ±



1 AIRCRAFT, MISSILES are exposed to wide range of temperatures as they reach different altitudes — causing unique air conditioning design problems

Aero-Space Industry Opens New Horizons For Air Conditioning Design

By ROBERT BERNER
Staff Design Engineer
Technical Development Dept.
Baltimore Div.
The Martin Co.

WE NEED ONLY pick up a magazine or a newspaper these days to become aware of the fact that the aircraft and missile industry is getting many headlines. Possibly the use of the term aero-space industry might be more appropriate. If we neglect those headlines which have resulted purely from a demand for action following the arrival of Sputnik and the later Lunik, we still find many headlines which are a result of technical achievements which challenge the imagination.

Of immediate direct interest to many of us is the initiation of commercial jet travel, which permits a sports writer this summer to witness the New York Yankees in an afternoon home game, and then, at its completion, to travel by helicopter to Idlewild Airport and to board a jet flight, arriving in Los Angeles in time to see the Dodgers in action in the Coliseum that same evening.

It is natural for those of us who are engaged in specialty areas, such as air conditioning and refrig-

● The problems involved in air conditioning aircraft, missiles, and rockets are vastly different from those encountered in the design of conventional systems. This article compares these problems and discusses the ground rules on which the designs are based. It briefly traces the development of air cycle and vapor cycle systems and tells some of their limitations. Also discussed are missile and rocket air conditioning systems in connection with the mission to be accomplished.

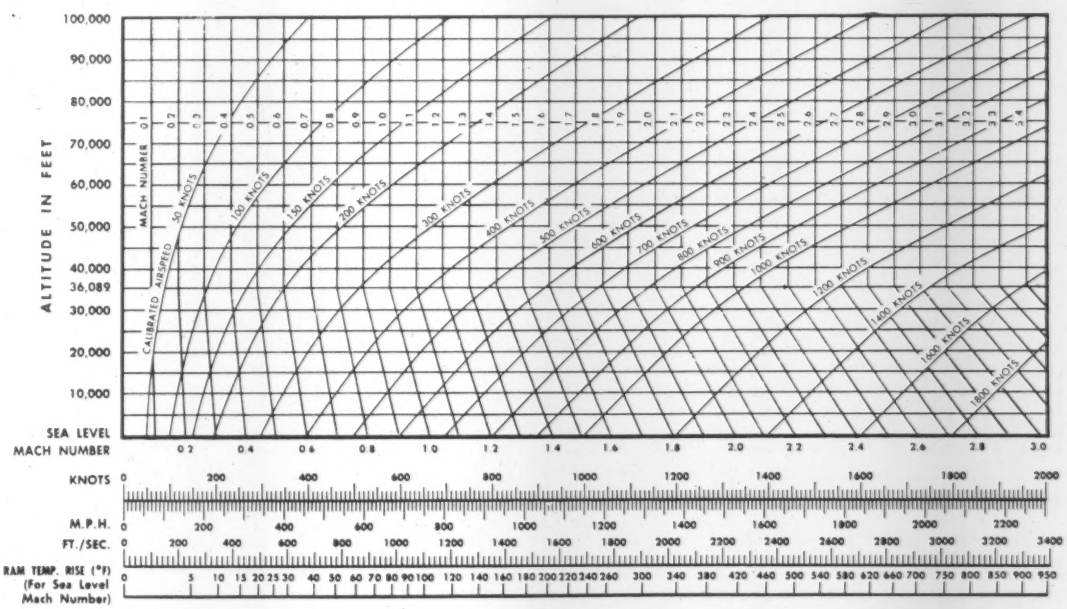
eration, to wonder what parts such specialties play in the development of these programs. In discussing the conditioning systems of aircraft and missiles we will attempt to limit any comments to those areas which differ from the problems you normally encounter in your daily work. We will also stop short of a discussion of the vehicles which are required to explore someone else's solar system.

Must Establish Ground Rules

In order to design any system, it becomes necessary first to establish the ground rules on which the system design is to be based. These include determining values for such things as external temperatures, interior compartment temperatures, humidity levels both in the external air and the compartment, and ventilation air requirements.

Since aircraft and missiles are mobile devices, they are subject to a wide range of temperatures, often within short periods of time. Fig. 1 indicates the range of temperatures which designs are required to meet. These vary at sea level from −65 F to +103 F. Commercial aircraft are subject to somewhat less rigid requirements and their design is usually based on temperatures from −40 F to +100 F. Amount of moisture, usually coupled with high design temperatures, varies with specifications. However, for military design we are usually required to use an 80 F dewpoint unless defogging is involved

2 TO TEMPERATURES expressed in Fig. 1 must be added heat resulting from forward speed of vehicle, i.e., ram temperature rise. This additional heat load must be considered in aircraft air conditioning



(in which case an 85 F dewpoint is used). These values result in air which is saturated at about 9000 to 10,000 ft altitude. Air above this altitude is assumed to be saturated. For commercial applications the values again are somewhat less stringent and the usual dewpoint is about 65 F.

The temperatures shown in Fig. 1 could occur, however, only if we were not in motion. In other words, they would be the values recorded during balloon flight. When we add forward motion it becomes necessary to include an additional factor; namely, that of the ram temperature rise or aerodynamic heating resulting from the forward speed of the vehicle.

Fig. 2 gives some idea of the values involved. Speed is indicated in terms of Mach number, which is the speed of the vehicle relative to the speed of sound at that particular condition. Mach 1 indicates a speed equal to that of sound, Mach 2 indicates a speed twice that of sound, etc.

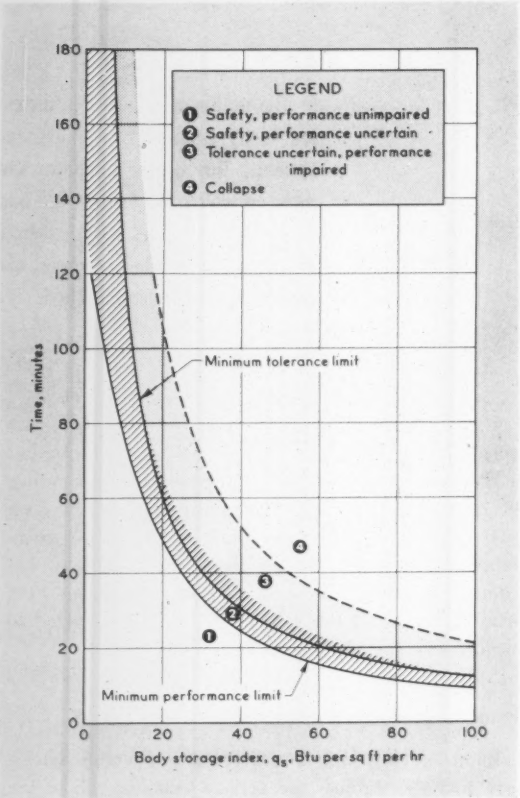
Looking at the ram temperature rise chart on this figure, we find that with the addition of these temperatures, and allowing for the fact that only about 90 percent of this ram temperature rise actually appears at the skin of the vehicle, at a speed of Mach 2 we are at a temperature level of about 250 F. This is the same as though the vehicle were flying in air at that temperature.

Similarly, for a Mach 3 flight speed we find that the temperature is in the 600 to 650 F range. In order to better evaluate these temperatures they might be compared with the fact that a roast of meat is usually prepared by heating at a temperature of about 450 F for about one-half hour and then retained at a temperature level of about 350 F for several additional hours.

In establishing interior temperature levels, the values selected are usually somewhat higher than those used for ground applications — usually about 75 to 80 F dry bulb. These values are used since the close proximity of passengers to the aircraft walls tends to produce a cold wall effect. In addition, since the cabins are pressurized to values somewhat less than sea level pressure, there is an increased tendency to evaporate body moisture and this also produces an additional cooling effect.

In general, we do not attempt to control moisture in the interior compartment during flight. At altitude, the air on board the vehicle is dry and there is a gradual tendency to produce drying and thus remove internally generated moisture. The addition of moisture to raise the humidity level would in most cases result in condensation on portions of the aircraft structure and resultant tendency for insulation to absorb this moisture in a wicking fashion. The net result would be increased aircraft weight.

Extensive tests conducted in connection with this



problem for some of the newer jet aircraft have indicated that, for the time periods likely to be encountered in flight, there is little effect on the body due to the low humidity levels as long as there is sufficient liquid available for replenishing body moisture.

In connection with military applications we face a very different type of problem. Here, we encounter wide variations in air temperature, wall temperature, pressure level, moisture level, air velocity, and clothing of the flight crew. For these types of designs it is usually necessary to resort to a means of computing the body storage index. It is possible to evaluate all of the above factors, and to combine these in such a way that we can determine whether the body is in thermal balance, or whether the body is increasing the amount of heat which is being stored. In the latter case, an increase in amount of heat storage results in a decrease in temperature tolerance level. Fig. 3 indicates the extent to which body storage is a factor in time tolerance.

In establishing ventilation requirements, we encounter large variations in both air pressure and temperature, and these produce wide variations in air density. For this reason, we normally express our air requirements in terms of pounds per minute rather than in cubic feet per minute. Minimum ven-

3 THERMAL BALANCE of human body is also important. Chart at left relates body storage index to time

tilation requirements are usually 1 lb per min of outdoor air provided at sea level conditions, with additional air being provided by recirculation. Present designs usually employ larger air flows, since the air flow is usually determined by the cooling requirements rather than the minimum ventilation requirements.

In addition to the previous items, it is necessary for us to control the pressure level. This is due to the fact that the human being is primarily a sea level person. In order to sustain life and maintain body functions it is necessary to maintain a minimum oxygen pressure level inside the lungs. Without pressurization, as we increase altitude this lung oxygen level decreases. We reach a value in the vicinity of 18,000 to 20,000 ft at which body functions are impaired, and it becomes difficult or impossible to sustain life.

We can correct this situation by the use of oxygen, but the problem simply transfers itself to a new altitude level in the vicinity of 35,000 ft and then the cycle repeats itself. Thus, it is possible to breathe pure oxygen and still be unable to maintain a sufficient oxygen pressure level in the lungs to maintain body function.

There is also an altitude level which is determined by the formation of gases in the blood stream. This is normally referred to as "bends." There is a significant increase in the occurrence of "bends" at altitudes just above 25,000 ft so that this level forms a practical top limit. In addition, if we went to higher altitudes we would reach an absolute pressure level limit at about 63,000 ft, since at this altitude level the blood would boil at body temperature, and it would be impossible to sustain life.

Compute Heating, Cooling Loads

Having established the ground rules for the design of the system it is then possible to proceed to establish the size of the job; in other words, to compute the heating or cooling loads. Calculation of the transmission load through the aircraft structure is accomplished in a manner similar to that for ground applications except for several basic points. Since the structure is comprised of metallic frames and skin, it is necessary to consider the fin effect which results. In addition, external film coefficients are very much higher in most cases than those for surface applications. Values of 30 to 50 Btu per hr per sq ft per F are not uncommon. These, however, do decrease at altitude. Since we also encounter wide variations in outside temperature due to changes in aircraft velocity, it becomes necessary to consider the problem of transients in our heat transmission calculations.

Solar loads primarily affect transparent areas since the solar input to the structure tends to be overridden by the ram temperature rise. Since we are at altitude, we cannot depend on shadow effects of adjacent buildings, nor can we readily use external awnings. As a result, at an altitude range of about 50,000 ft the solar input becomes constant at about 430 Btu per hr per sq ft.

Outside air infiltration is a problem on unpressurized aircraft. For pressurized aircraft, of course, the air leakage is from the cabin to the exterior and we have the problem of maintaining adequate sealing. It is interesting to note that cigarette smoking aids this problem. There is a tendency for structural leakage to decrease with time as the deposit of nicotine tars tends to seal off the points of leakage. Personnel loads are also included and these are usually computed on the basis of data available in the ASHRAE Guide, with allowance being made for increased activity level of crew personnel.

In addition to the above loads, we have a major problem area occurring in the defrosting and de-icing of transparent areas, particularly in the case of fighter aircraft. High performance aircraft can come from high altitudes to low altitudes within a very short period of time. In so doing they bring transparent areas which are low temperature into areas of high humidity level. Use of thermal means for reducing this fogging or frosting produces a large additional heat load on cooling systems.

For commercial applications we also encounter a large pulldown cooling load. Aircraft are frequently parked in a closed condition and exposed to solar loads for periods of time, and this results in the entire structure of the aircraft reaching an elevated temperature. The problem of removing this stored heat within a reasonably short period of time can have a major effect on cooling system design.

In another article, to be published in an early issue, the subjects of system design and equipment selection will be discussed. Also, some of the problems posed by completely sealed cabins will be described. ⋕

Figure credits: Fig. 1, MIL-STD-210A; Fig. 2, Airspeed Altitude Indicator-General Electric Co.; Fig. 3, WADC TR 53-346.

COAL

What every engineer should know

Coal is a vital fuel in our industry. To generate heat for many applications, millions of tons are produced and burned each year. How much do you know about it—its composition, classifications, heating values? What do rank and grade of coal indicate? Heating, Piping & Air Conditioning herein continues its question-and-answer series covering these and other facets of this all-important heat source.

By WILLIE HAMMER
Chief, Installations Branch
Headquarters
Ordnance Weapons Command

Q. What is meant by the term "moist"?

A. Moist refers to the natural bed moisture of coal but does not include water visible on its surface.

Q. To what extent will moisture in coal affect boiler efficiency?

A. There will be a reduction in efficiency of approximately 0.1 percent for each 1 percent of moisture in the coal.

Q. What is the difference between drying and dewatering of coal?

A. Drying is usually the removal of moisture by use of heat. Dewatering is removal of suface water by mechanical means.

Q. What is fixed carbon?

A. When a proximate analysis is made, the percentages of moisture, ash, and volatile matter are subtracted from 100 percent. The difference is fixed carbon. It actually may contain slight amounts of other substances, such as sulfur, and hydrogen, oxygen and nitrogen which were not completely driven off when the amount of volatile matter was determined.

Q. Why are comparisons of fixed carbon (FC) and volatile matter (MV) sometimes made on dry, mineral-matterfree bases?

A. Because of the inconstancy of moisture conditions, comparison of coal samples would not be accurate unless made to a prescribed standard, which in this case is the dry condition. The use of the term "mineral-matterfree fixed carbon" permits identification from the misnomer "fixed carbon" which, by definition, is the residue left after volatile matter is distilled off, but which actually contains noncarbon material. Classification of coal by rank is made according to fixed carbon, volatile matter, or heat content on mineral-matterfree bases.

Q. What formula is used for calculation of fixed carbon on the dry, mineral-matterfree basis?

A. Using S for sulfur, A for ash, and M for moisture, all expressed as percentages, the most commonly used (Parr) formula is:

$$\text{Percentage dry mineral-matterfree FC} = [(\text{FC} - 0.15S)/[100 - (M + 1.1A + 0.55S)]] \times 100$$

which is sometimes simplified to:

$$\text{Percentage dry mineral-matterfree FC} = [\text{FC}/[100 - (M + 1.1A + 0.1S)]] \times 100$$

Q. Since the original determination of volatile matter excluded moisture, and volatile matter itself contains no mineral matter, what is the object in specifying it on the dry, mineral-matterfree basis?

A. Dry, mineral-matterfree volatile matter is taken as 100 minus the percentage of dry mineral-matterfree fixed carbon. These two items are the amounts

of the combustible constituents present in the coal, a measure of the ease of ignition, and a guide as to whether or not the coal is "smokeless."

Q. Why is heat content expressed on a moist, mineral-matterfree basis? What formula is used for its determination?

A. A moist basis permits comparison of the heating value of coal as it is in its natural state. In many cases, identification of the field or mine can be made from this and similar data. It determines, in some cases, the rank of the coal. The Parr Formula used to determine heat content on the moist, mineral-matterfree basis from laboratory analysis data is:

$$\text{Moist, mineral-matterfree Btu} = [(\text{Btu} - 50\,S)/[100 - (1.08A + 0.55S)]] \times 100$$

which for quick approximation, is sometimes simplified to:

$$\text{Moist, mineral-matterfree Btu} = [\text{Btu}/[100 - (1.1\,A + 0.1\,S)]] \times 100$$

Q. What effect does the presence of sulfur in coal have?

A. As mentioned, iron sulfide has a tendency to lower the softening temperature of ash and therefore will contribute to problems of clinkering and slagging. Combustion of the sulfur will result in the creation of acids in the flue gases which will be corrosive to stacks, breechings, economizers, and air preheaters. The oxidation of iron pyrites (FeS_2) liberates heat which contributes toward the increase of temperature in a pile of stored coal and to spontaneous combustion.

Q. Approximately how much sulfur might be present in coal? In what forms is it present?

A. The amount may run from 0.5 to 6.0 percent. It may be present as iron pyrites from formations of rock, organic sulfur from compounds originally in the vegetation from which coal was formed, or as sulfates produced by the oxidation of sulfides or as gypsum.

Q. When analyses are made of coal samples, what tests are usually included?

A. A proximate analysis can be made which determines amounts in percentages of moisture, volatile matter, fixed carbon, and ash. An ultimate analysis includes determination of amounts of carbon, hydrogen, sulfur, nitrogen, and ash by test and amount of oxygen by difference from 100. Special tests, such as for phosphorous, can also be made. The test which is usually made is that used to determine whether or not there has been compliance with provisions of specifications. For operating purposes, the proximate analysis is usually used.

Q. What is Dulong's Formula?

A. Dulong's Formula is an equation to determine the heating value of a fuel based on its ultimate analysis: Btu per lb $= 14{,}544C + 62{,}028[H_2 - (O_2/8)] + 4050S$. The symbols are expressed in proportionate parts by weight. The results are accurate to about 1 percent for higher rank coals and 4 to 5 percent for lower rank.

Q. What is the difference between the gross, net, higher, and lower heating values?

A. The gross and higher heating values are the same. Likewise, the net and lower heating values are the same. The higher heating value (*HHV*) refers to total heat obtained in a test made in a calorimeter of a fuel and includes the latent heat of condensation of water formed from the combustion of hydrogen. The lower heating value (*LHV*) is the higher heating value less the latent heat of condensation due to the combustion of hydrogen present. The relationship between the two heating values therefore is: $LHV = HHV - wr$; where w is weight of water and r is the latent heat per unit of weight at the pressure in the calorimeter. In the U.S., gross or higher heating value is normally used.

Q. A sample of coal indicates the following: carbon 82.5 percent; hydrogen, 4.0 percent; oxygen, 2.6 percent; ash, 9 percent; nitrogen, 0.9 percent; and sulfur, 1.0 percent. What will be the heating value, as calculated by the Dulong Formula?

A. Heating value $= 14.544 \times 0.825 + 62.028\,[0.04 - 0.026/8] + 4050 \times 0.01 = 14.322$ Btu per lb.

Q. What does each of the following indices show: (1) weathering, (2) agglomerating, (3) agglutinating, (4) free swelling?

A. (1) The *weathering* index is a measure of the tendency of coal to slack or break up due to changes in atmospheric moisture and temperature. (2) The *agglomerating* index is a measure of the caking properties of a coal. (3) The *agglutinating* index is used to determine changes in coking characteristics due to storage of coal. (4) The *free swelling* index indicates the tendency of a coal to swell on being heated in a furnace.

Q. How is each of these indices determined?

A. (1) *Weathering*: Lumps of coal 1 to 1½ in. in size are alternately dried, wetted, and dried again. They are then screened and the amount passing

through a mesh with openings 0.263 in. square, expressed as a percentage of the total original dry weight, is the weathering index. If the percentage or index is less than 5 percent, the coal is considered to be nonweathering. (2) *Agglomerating*: After a sample of coal has been tested for volatile matter, the residue is examined for appearance and structure. If the residue is in the form of a button which will support a 500 gram weight without pulverizing, or if the button shows swelling or cell structure, the coal is considered agglomerating. (3) *Agglutinating*: Pulverized coal is mixed with fine sand, made into buttons, and carbonized in a furnace. The weight which the button will support without crushing is the agglutinating index. (4) *Free-swelling*: A 1 gram sample of finely ground coal is heated in a furnace. The shape of the residue is then compared with 17 standard profiles graduated from 1 to 9 in half units. The greater the swelling, the higher the numerical rating.

Q. How are the different types of coal classified?

A. Coal may be classified in a number of ways such as rank, grade, size, variety, and use. One of the principal methods in the U.S. is by rank and group as designated by the American Society for Testing Materials.

Q. What do rank and grade of coal indicate?

A. Rank is the standing of the coal in relation to the degree it has metamorphosed from lignite to anthracite and gives a rough indication of the volatile matter, carbon, moisture content, calorific value, and age of the coal. *Grade* indicates size, calorific value, ash, ash-softening temperature, and sulfur content of a coal.

Q. What are the various ranks of coal? Which are high and which are low ranks?

A. The ASTM (in D388-38) divides coal into four ranks: Rank I — anthracite; Rank II — bituminous; Rank III — subbituminous; and Rank IV — lignite. Ranks I and II are considered high rank coals; III and IV are low rank. Peat is not included, since it is not used as a fuel in the U.S. because of its very high moisture content (80 to 92 percent).

Q. Are there any countries which use peat as fuel?

A. Eighty-five percent of the world production of peat for fuel is in Russia, where its use amounts to about 10 percent of the fuel required for electric generating plants. It is also used in Sweden, Eire, and West Germany. Special furnaces have been built which permit peat to be burned after its moisture content has been reduced to a maximum of 50 to 55 percent.

Q. Does peat have any other use?

A. It is used in the U.S. for soil conditioning and improvement, as a fertilizer, stable bedding, and packing material.

Q. What would be the analysis of typical peat?

A. On a moisturefree and mineral-matterfree basis, it can be analyzed two ways: (1) fixed carbon — 30 percent, volatile matter — 70 percent; or (2) total carbon — 56 percent, sulfur — 1 percent, hydrogen — 5 percent, oxygen — 34 percent, and nitrogen — 4 percent.

Q. Are there large deposits of peat in the U.S.?

A. Peat deposits are estimated at about 14 billion tons on an air dried basis. Of this, approximately 75 percent is in Minnesota, Wisconsin, and Michigan. Florida has deposits of 2 billion tons, while more than 20 other states have small amounts.

Q. Is there more than one type of peat?

A. One system classifies peat in four general groups: *sphagnum* — from moss mixed with small quantities of shrubs, ferns, and other plants; *hypnum* — from disintegrated hypnum plants, other mosses and plants; *reed sedge* — plants of the sedge family, swamp plants, and grass; *shrub-and-tree* — from tree trunks, roots, bark and twigs, usually mixed with remains of leaves and ferns. Another system classifies peat by different types of mosses and grasses; still another classifies them as turfy, fibrous, earthy, or pithy.

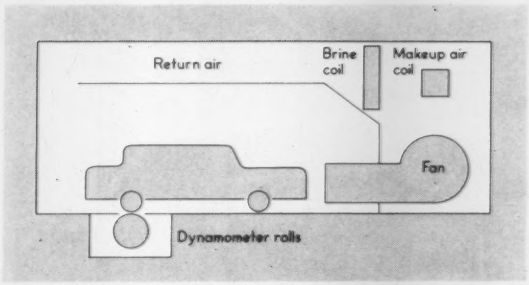
Q. What is the relationship between rank and age of coal?

A. Lignite is the youngest, then subbituminous, bituminous, and anthracite. Coals of the same chronological age may be in different ranks because of the differences in conditions (pressure and heat) under which they were formed.

Q. How many different types of lignite are there? What are the characteristics of lignite?

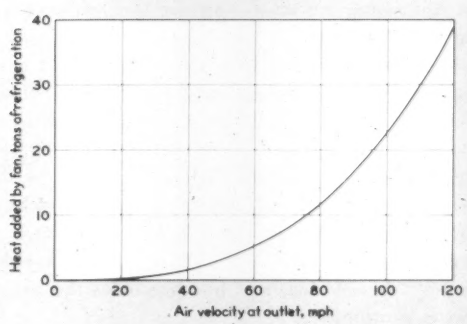
A. The ASTM divides lignite into two groups: lignite and brown coal. Both are specified as having moist Btu content less than 8300 per lb. Lignites are high in moisture (30 to 45 percent) and volatile matter (25 to 50 percent), and sometimes have woody formations which permit fairly easy recognition of the fact that they were derived from trees and other vegetation. Color varies from brown to black and some deposits may be visually indistinguishable from subbituminous coal.

More questions and answers on coal will be presented in an early issue. ≠



1 CHASSIS TESTING ROOMS simulate actual road driving conditions. Large centrifugal fan can direct over 100,000 cfm of air at front of car. Return air is picked up through ceiling where its heat is absorbed by brine coil

Brine System Maintains Artificial Weather in Auto Fuel Lab



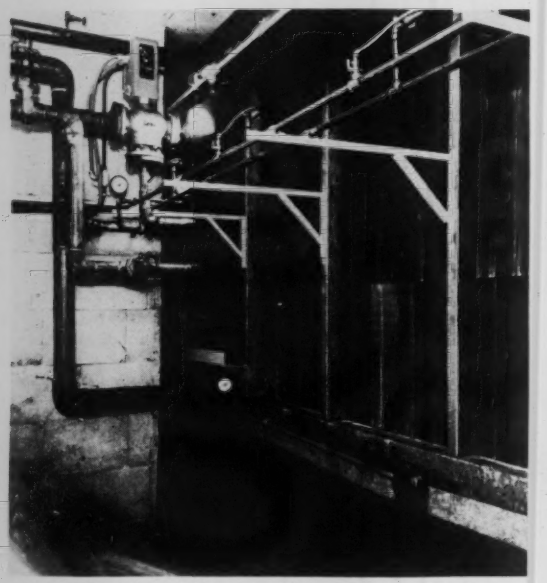
2 HEAT ADDED BY FAN is as represented above for given air velocities at outlet. Fan heat is therefore a function of discharge velocity and is factor in sizing coil

• Automotive fuels and lubricants are being researched and tested today in a new laboratory that features a brine coil refrigerating system that can maintain a constant temperature in the test room while a 100 mph road test is being simulated. This test chamber is used to perform tests in solving problems of carburetor icing, cold weather starting, and other wintertime driving headaches. Why was a brine coil system chosen? The author herein explains the reasoning behind its selection and briefly tells how it operates.

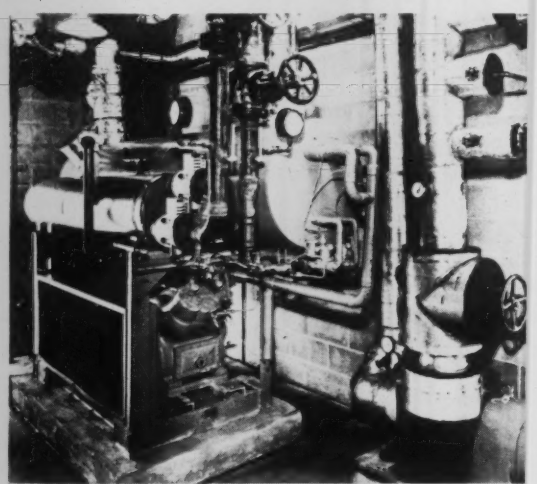
By PAUL LONDON
Air Conditioning & Refrigeration Div.
Worthington Corp.

THE PETROLEUM industry's constant search for fuels and lubricants that exceed the demands of our present-day automobiles created a need for a testing program that could be carried out year 'round in one location. Before such test laboratories were built, cold-weather gasolines could be tested only during the winter, and even then it was necessary to travel long distances in order to test for prolonged periods. Since the introduction, in 1947, of refrigerated automotive test chambers, more than 12 petroleum and automotive companies have found it desirable and profitable to research their products indoors.

The latest in a series of automotive test chamber refrigerating systems has been completed at the Sun Oil Co.'s laboratories at Marcus Hook, Pa. One fea-



3 ETHYLENE GLYCOL BRINE COIL combines advantage of high thermal inertia with low cost heat removal



4 PACKAGED CHILLER with full capacity control keeps water-ethylene glycol at constant temperature

ture of these new laboratories is that the testing can be carried out simultaneously in the engine test cell and the chassis dynamometer room, since the refrigerating equipment for each room is separate, although located in one area.

The design of the system begins with the heat load. All the required test conditions are submitted to the consultant for evaluation and load determination. If the automobile is to be run at a steady speed, the heat rejection of the engine can be measured by first determining the calorific value of the fuel and the fuel consumption rate at the speed and torque load selected. The load is the resistance to the rear wheels, which are driving the dynamometer rolls. The power can be adsorbed by an eddy brake, the heat of which is dissipated by water to the cooling tower.

From handbook data on vehicle performance, we can calculate the heat rejected to the room by the radiator, the exhaust system surfaces, the transmission, the differential, and the friction of the tires as they drive the rolls.

Testing Rooms Simulate Road Conditions

Since the chassis testing rooms are designed to simulate road conditions as much as possible, the discharge of a large centrifugal fan capable of moving over 100,000 cfm is directed at the front of the car. The return air is usually directed through a false ceiling at low speeds to the fan. With this arrangement, pictured in Fig. 1, it is reasonable that we should absorb the heat rejected to the room with a coil in the return air. This air system can create static pressures across the fan as high as 7 in. water gage at maximum volume. The heat added to the room by the fan is appreciable and is represented by a typical curve, shown in Fig 2, giving the heat added as a function of discharge velocity. We can now calculate the data to size the coil in the return air:

Heat absorbed by coil = heat rejected by vehicle + heat added by fan + wall transmission and infiltration loss

At this point, we must consider the refrigeration cycle and the means of operating the coil. From a cost standpoint, a direct expansion system is the most desirable. With refrigerant as the cooling medium, the compressor and motor size is at a minimum. The test conditions, however, require temperature control of ± 2 F, not only with steady loads, but also for the varying load that will be presented when the vehicle is undergoing acceleration and deceleration tests. For this condition, a system with a fairly high thermal inertia must be selected, and this precludes the use of direct expansion.

Two remaining alternatives are a flooded coil and a brine coil. In spite of the fact that flooded coils with a refrigerant pump have been used successfully in a similar but larger system, the cost of this type of system, with its associated equipment, is relatively high compared to the cost of a brine system. When using flooded refrigerant coils and pump, it was necessary to use an oil recovery system, an elaborate arrangement to lubricate the complicated seal on the refrigerant pump, and a large flash tank to handle the 5000 lb of refrigerant No. 22.

Brine System Combines Advantages

The ethylene glycol brine coil, illustrated in Fig. 3, used in Sun's new laboratory combines the advantage of high thermal inertia with the low cost of di-

rect expansion heat removal. To maintain a constant room temperature, two completely independent control systems are utilized. A packaged chiller with full capacity control keeps the water-ethylene glycol mixture at a constant temperature.

The air temperature at the radiator grille is maintained at a selected temperature between zero and 100 F by a motorized three-way mixing valve. The controller for the valve is electronic, using a resistance bulb as the sensing device. The brine temperature, selected by the operator, is determined by the humidity requirements of the test. The brine chiller is sized by the following relations:

Heat absorbed by chiller = heat absorbed by coil + heat added by brine pump

Use Averaging Method

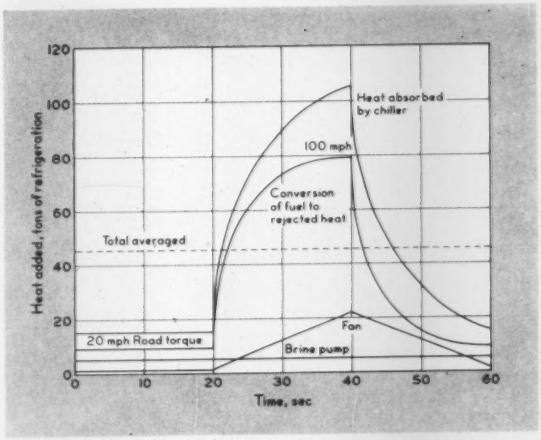
Sizing the equipment for acceleration loads requires the use of an averaging method that utilizes the thermal inertia of the brine system. The petroleum companies, through many years of road tests, are able to predict fuel consumption and fuel conversion to rejected heat during these accelerations. Since the acceleration tests are cyclic, the total load can be computed for one cycle. One of the curves shown in Fig. 5 indicates an approximate relation of heat rejected by the vehicle for specific portions of the cycle. Superimposed on this is the heat added by the fan and the brine pump. By adding all of these areas, we can draw a total area which, when averaged out on a straight line, gives the heat load for the cycle. To this must be added the infiltration and transmission losses.

During these tests, the engine is consuming air from the room. This air must be replaced. For this installation, a 10-row brine coil was installed in the chamber wall on the suction side of the fan. All entering air is precooled to room conditions by means of this coil.

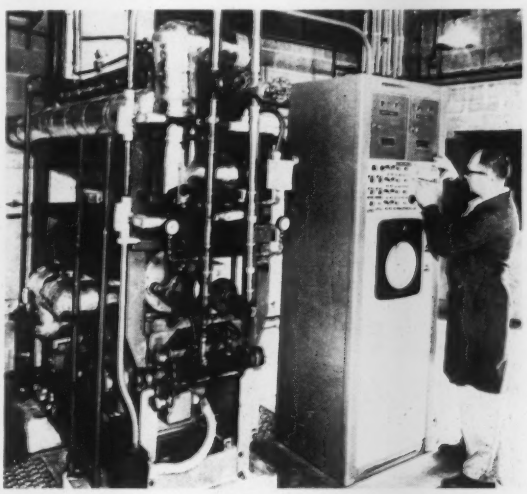
High Air Speed Combats Frost

In the 1400 cu ft engine test cell, Sun can quickly cool an engine to −20 F, since all the air passes through a direct expansion coil five times a minute. The high air speed through the coil helps to blow off a major portion of the frost as soon as it accumulates. Four thousand cfm of air is aimed directly at the engine undergoing tests. Since air diffusion in this case would not be beneficial, it is delivered by an open duct. Air temperature is maintained by means of face-and-bypass dampers in front of the cooling coil. Coil surface temperature can be selected from the control panel to avoid coil frosting at room conditions above 32 F. This is done by a remotely controlled evaporator pressure regulator.

The room itself, of masonry and cellular glass



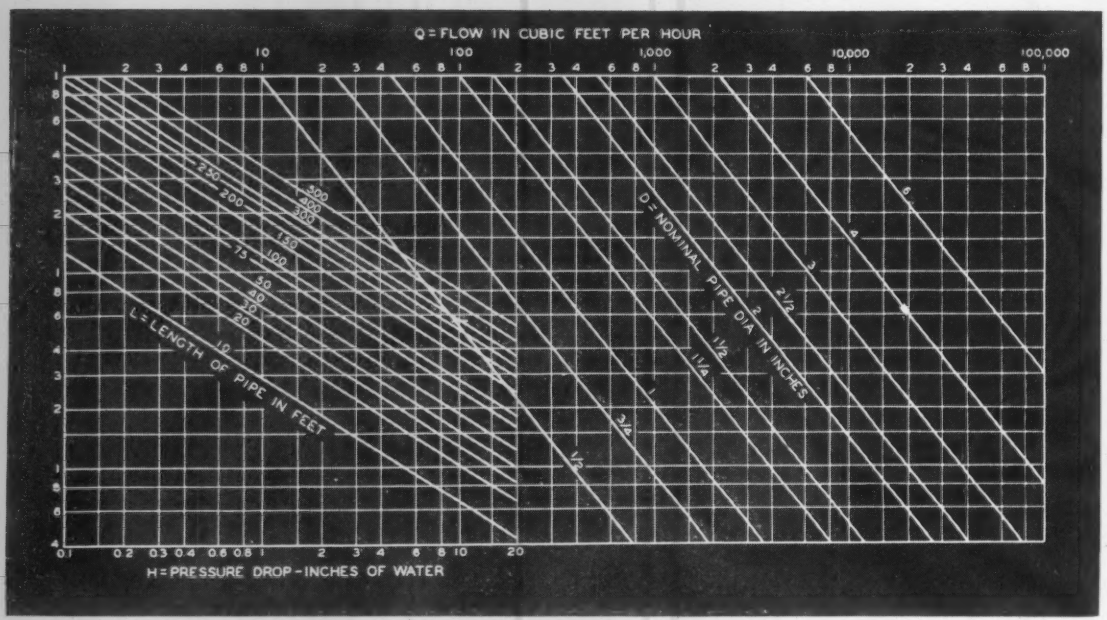
5 DETERMINING REFRIGERATION needed at chiller for acceleration loads required use of averaging method. To average of total for all loads must be added infiltration and transmissions losses



6 TWO-STAGE CONDENSING UNIT can pull 1400 cu ft engine test cell temperature from 90 F down to −20 F in six hours. Unit supplies air handling unit which can also be used to heat cell

block construction with a heavy-load-bearing concrete floor, can be pulled down from 90 F to −20 F in six hours by means of the two-stage, 25 hp condensing unit shown in Fig. 6. This unit, which occupies a floor space of 2 ft × 4 ft, supplies refrigerant to a modified air handling unit mounted over the test cell. In addition to maintaining the room temperature at below zero, this same unit can quickly heat the air by means of a nonfreeze steam coil, and then keep it at the desired temperature. Additional capacity, if required for certain test conditions, can be had by using a brine coil in the air unit. The control panel lets the operator select a test temperature and maintain it within 1 F. ⫩

Photos courtesy Sun Oil Co.



1 GAS PIPING PRESSURE DROP is given above as function of pipe diameter and rate of gas flow. Chart simplifies selection of gaseous fuel pipe sizes

How to Design Gas Piping Systems For Direct Fired Heater Installations

1) What type of gas should be used?
2) Where should heaters be located?
3) How much gas to each heater?
4) What gas pressure at each heater?
5) What pipe sizes?

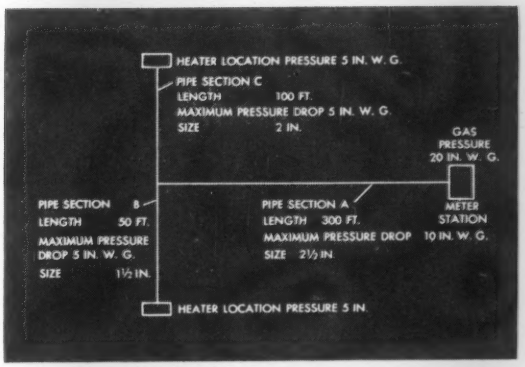
By M. H. STERN
Industrial Market Manager
Lennox Industries Inc.

GASEOUS FUELS are usually classified by the source from which they originate. This in turn determines their chemical composition. Typical gas analyses and the properties that affect the determination of pipe sizes in a distribution system are given in Table 1.

The heat value (Btu content per cubic foot) varies with the type of gas being used and will determine the quantity required for the specific capacity of the heating system. The popular types of gases being used today with large capacity space heaters are natural, propane, and coke oven. When natural gas is supplied on an interruptible basis, a standby fuel has to be available. Propane or a mixture of propane and air is often selected to be the standby, since the same distribution system can be used for either fuel.

Coke oven gas is available as a fuel in many indus-

2 WHAT PIPE SIZES will satisfy pressure requirements of heaters in this layout? Follow step-by-step procedure described in text


HEATER LOCATION PRESSURE 5 IN. W. G.
PIPE SECTION C
LENGTH 100 FT.
MAXIMUM PRESSURE DROP 5 IN. W. G.
SIZE 2 IN.
GAS PRESSURE 20 IN. W. G.
PIPE SECTION B
LENGTH 50 FT.
MAXIMUM PRESSURE DROP 5 IN. W. G.
SIZE 1½ IN.
PIPE SECTION A
LENGTH 300 FT.
MAXIMUM PRESSURE DROP 10 IN. W. G.
SIZE 2½ IN.
METER STATION
HEATER LOCATION PRESSURE 5 IN.

tries since it is a byproduct and is a relatively inexpensive source of heat even though the Btu value per cubic foot is approximately one-half that of natural gas. Coke oven gas, in its raw state, contains large quantities of sulfur compounds and is commonly referred to as sour gas. Natural gas is termed a sweet gas, since the quantity of sulfur compounds is small when expressed in grains of sulfur per cubic foot of gas. Scrubbers are normally used to reduce the sulfur content of sour gases and to eliminate other impurities that might harm the fuel burning equipment.

The sulfur content in a fuel is mainly of concern because of its corrosive effects. During the combustion process the sulfur forms sulfur dioxide which, when combined with moisture, produces an acid which attacks heating surfaces and shortens the life of the heating equipment.

The flue gases resulting from the combustion of a sour gas must be above the temperature at which condensation occurs in the flue products (dewpoint). For this reason, sour gases should not be used with combustion equipment in which the Btu input is varied below the rated capacity of the heater.

A term commonly referred to when dealing with gaseous fuels is specific gravity. The specific gravity of a gas is simply the ratio of the weight of the gas per cubic foot to that of standard air. The specific gravity of standard air would be 1.0, and gases heavier than air would be greater than 1.0 and lighter gases less than 1.0. Flow pressure drop charts are based on a particular specific gravity. Corrections must be applied for other specific gravities when designing gas piping systems.

Two classifications of gas distribution systems in terms of gas pressure are encountered in the large capacity heater field. High pressure distribution systems refer to those installations with available pressures in the range of 2 to 5 psi. It is not uncommon

TABLE 1 — GAS ANALYSES and properties that affect pipe sizes for distribution systems for gas fired heater installations are as follows

Type	Source	CO_2	O_2	N_2	CO	H_2	CH_4	C_2H_6	C_3H_8	C_4H_{10}		Specific gravity	Btu per cu ft Gross	Btu per cu ft Net
Natural gas	Typical	....	....	0.8	....	....	83.4	15.8	....	.....		0.61	1129	1021
Propane	Commercial (natural gas)	....	.....	....	....	....	....	2.2	97.3	0.5		1.55	2558	2358
Propane	Commercial (refinery gas)	....	....	....	....	....	....	2.0	72.9	0.8	C_3H_6 24.3	1.77	2504	2316
Butane	Commercial (natural gas)	....	....	....	....	....	....	....	6.0	94.0		2.04	3210	2961
Butane	Commercial (refinery gas)	....	....	....	....	....	....	....	5.0	66.7	C_4H_8 28.3	2.00	3184	2935
Butane-air	.....	....	....	....	....	....	....	....	....	17.2	Air 82.8	1.16	550	516
										(Illuminants)				
Reformed natural	Straight shot generator	2.1	0.3	1.5	13.6	48.3	33.0	....	....	1.2		0.41	559	497
Refinery oil	Vapor phase crack	0.2	0.2	0.5	1.2	13.1	23.3	21.9	....	39.6	.....	0.89	1475	1351
Oil gas	Portland, Ore.	1.2	0.5	2.4	7.7	54.2	30.1	....	....	3.9	.....	0.37	570	510
Coal gas	Contin. vert.	3.0	0.2	4.4	10.9	54.5	24.2	....	....	2.8	.....	0.42	532	477
Coke oven gas	Byproduct	2.0	0.03	4.8	5.5	51.9	32.3	....	....	3.2	.....	0.40	569	509
Producer gas	Bituminous	4.5	0.6	50.9	27.0	14.0	3.0	....	....	.....	.....	0.86	163	153
Blast furnace gas	.....	11.5	....	60.0	27.5	1.0	....	....	....	.....	.....	1.02	92	92
Blue gas	Bituminous	5.5	0.9	27.6	28.2	32.5	4.6	....	....	0.7	.....	0.70	260	239
Carburetted water gas	Heavy oil with blow run	6.0	0.9	12.4	26.8	32.2	13.5	....	....	8.2	.....	0.66	530	451
Carburetted water gas	High Btu	0.7	0.3	5.8	11.7	28.0	36.1	....	....	17.4	.....	0.63	840	770
Mixed gas	Natural, blue, producer, reformed natural	3.9	0.1	15.5	10.3	17.8	46.9	5.4	0.1	.....	.....	0.63	650	586
Mixed gas	Coal, natural	1.1	0.4	6.6	4.0	35.8	45.7	4.6	....	Ill. 1.8	.....	0.46	700	627
Mixed gas	Natural, coke oven	1.0	0.2	5.5	2.0	20.9	66.6	2.6	....	Ill. 1.2	.....	0.52	805	721
Sewage gas	Decatur, Ill.	22.0	....	6.0	....	2.0	68.0	....	....	.....	.....	0.79	690	621

to encounter these pressures in industrial plants, as the available pressure determines to a large extent the pipe size that must be used.

Regardless of the available pressure, it is highly important that an adequate supply of gas be provided at each heater location. If the pipe size selected is too small, the heaters will not be supplied with a sufficient amount of gas to meet their input requirements. Nuisance shutdown of the equipment will also occur, since low gas supply can cause pilot failures. Pipe sizes that are selected arbitrarily will usually be larger than necessary, thus increasing costs.

Outline Design Steps

Here is a suggested procedure for correctly designing a gas distribution system:

1) Determine the type of gas to be used, Btu content, specific gravity, and available gas pressure. This information can often be obtained from the local gas company.

2) Locate heaters and gas meter station on the floor plan.

3) Note total fuel consumption and cubic feet of gas to be supplied to each heater:

$$\text{Cfh} = \text{Btu per hr output}/(0.80 \times \text{Btu content})$$

4) Select the gas pressure to be maintained at each heater location. This pressure is determined by requirements of fuel burning equipment provided with the heater.

5) Select pipe sizes in accordance with allowable pressure drop.

Fig. 1 is suggested as a source for determining the pipe sizes. The chart is based on a gas having a specific gravity of 0.60. For other specific gravities the pressure drop obtained must be multiplied by the conversion factors in Table 2.

Example Shows How to Size Piping

Given the heater layout shown in Fig. 2, determine the pipe sizes that will provide adequate gas supply at each heater location.

Data:

Gas . . . natural, 1000 Btu per cu ft, 0.60 sp. gravity

Heater sizes . . . two 2 million Btu per hr output
Gas pressure required at heater .... 5 in. WG
Meter supply pressure ..... 20 in. WG

Procedure:

1) Determine fuel consumption:

$$\text{Cfh} = \text{Total Btu per hr output}/(\text{Heater efficiency} \times \text{Btu per cu ft})$$
$$\text{Cfh} = 4 \text{ million}/(0.80 \times 1000) = 5000$$
$$\text{Cfh per heater} = 2 \text{ million}/(0.80 \times 1000) = 2500$$

2) Select pipe size for allowable pressure drop by arranging the data by sections and using Fig. 1 to determine the pipe sizes. Pipe section A is to handle the total fuel flow rate of 5000 cfh with an allowable pressure drop of 10 in. WG. At the pressure drop scale, locate the 10 in. WG line and follow it vertically until it intersects the 300 ft length diagonal line. At this intersection, move horizontally to the right until the vertical flow rate line of 5000 cfh is intersected. At this intersection the pipe size diagonal line is 2½ in. Always use the larger pipe size when the intersection falls between two pipe size lines. Use the same procedure to determine the sizes of pipe sections B and C. The results are recorded in the table below:

Pipe section	Flow, cfh	Design pressure drop*, in. WG	Length, ft	Pipe size, in.
A	5000	10	300	2½
B	2500	5	50	1½
C	2500	5	100	2

* Selected for minimum practical pipe size.

The importance of the initial pressure available at the meter station can be illustrated by redesigning the piping system for the previous example based on a meter supply pressure of 7 in. WG. The new data will be:

Pipe section	Flow, cfh	Design pressure drop*, in. WG	Length, ft	Pipe size, in.
A	5000	1.0	300	4
B	2500	1.0	50	2½
C	2500	1.0	100	3

* Selected for minimum practical pipe size.

The main pipe size has now increased from 2½ in. to 4 in. with the branch pipe sizes increasing also. It is obvious that the gas distribution system based on the higher meter supply pressure will be considerably less expensive and will provide an adequate supply of gas to the heaters.

Each heater will be provided with a regulator to reduce the line pressure to the operating pressure required by the burner. A regulator should not exceed a regulation ratio of five to one if good regulation is to be had. In other words, if the outlet pressure from the regulator is to be 5 in. WG, the inlet pressure should not exceed 25 in. WG.

When the line pressure does not permit a maximum regulation ratio of five to one, two regulators in series should be used and the line pressure reduced in two steps. ⋕

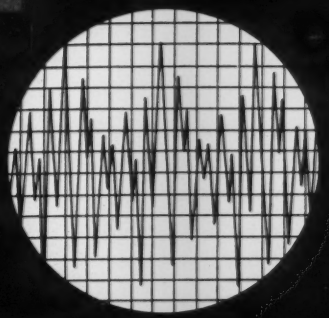
TABLE 2 — GAS SPECIFIC GRAVITY conversion factors for use with gas piping pressure drop chart

Specific gravity	Multiplier	Specific gravity	Multiplier
0.35	1.31	1.00	0.775
0.40	1.23	1.10	0.740
0.45	1.16	1.20	0.707
0.50	1.10	1.30	0.680
0.55	1.04	1.40	0.655
0.60	1.00	1.50	0.633
0.65	0.962	1.60	0.612
0.70	0.926	1.70	0.594
0.75	0.895	1.80	0.577
0.80	0.867	1.90	0.565
0.85	0.841	2.00	0.547
0.90	0.817	2.10	0.535

HPAC ENGINEERING DATA FILE

How to Avoid Noise Control Failures

- *Don't make system too quiet*
- *Assure good workmanship*
- *Consider noise generation of fittings*
- *Don't overlook the return-air system*
- *Isolate vibrating equipment*



The design of a quiet air conditioning system demands careful consideration of the many sources of noise it contains and the way that these noises can be transmitted to occupied spaces. Available design data provides a solid base for determining how much the primary paths of transmission must be treated to quiet the principal sources of noise. Such a design procedure was given in the July 1959 HPAC entitled "Some Noise Control Fundamentals."

Experience shows, however, that other paths of transmission and other sources of noise may inadvertently arise to upset the acoustic design. In this report, the experience of a number of engineers has been called upon to point out some of the ways in which a noise control design can fail. In many instances, case histories of noisy systems are used to emphasize the factors that must be considered in design and installation to avoid unsatisfactory results.

The editors are indebted to the following engineers for their cooperation in preparing this report:

W. R. Budde, Budde Sheet Metal Works, Inc.

R. W. Flanagan, Daniel B. Stevenson, Jr., consulting engineer

L. S. Goodfriend, and P. B. Ostergaard, Lewis S. Goodfriend & Associates, consulting engineers in acoustics

H. C. Hardy, Howard C. Hardy and Associates, consultants in acoustics

W. M. Harmon, United Sheet Metal Co., Inc.

J. J. Mann, Jaros, Baum & Bolles, consulting engineers

L. N. Miller, Bolt, Beranek and Newman, Inc., consultants in acoustics

R. J. Salinger, Naess & Murphy, architects and engineers

Case Histories of Noise Control Problems Show How to Avoid Them

MUCH attention has been given to controlling noise generated and transmitted by the mechanical equipment in air conditioning systems. The development of the high velocity air distribution system has been largely responsible for this activity though air conditioning must be given some credit for this too because of the higher volumes of air required and the virtual elimination of street noises during the summer.

While research has provided a lot of data with which to design[1] a quiet air conditioning system, undersirable noise levels can still result in conditioned spaces. Unsatisfactory noise levels can result even though current design procedures are followed explicitly. Why? Because it is easy to overlook obscure paths by which machine noise can be transmitted to the conditioned space, workmanship — that nebulous and sometimes difficult to control factor — is less than satisfactory, or sources of noise not quantitatively defined at present appear to upset the design. This area of noise control — which is more art than science — is learned principally through experience. To this end a number of problems that have been experienced and the way they have been solved are given below. Where possible, case histories from the experience of a number of engineers are included.

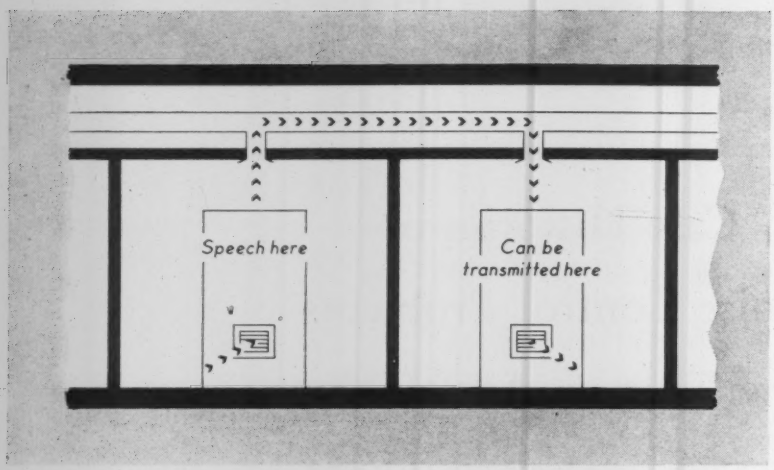
Although the high pressure system requires more attention from the noise standpoint than the low pressure system, many of the precautions given below apply to both.

Can A System Be Made Too Quiet?

Emphasis placed on reducing the noise of air distribution systems has lead to more attenuation in some cases than is necessary. At first thought this might seem desirable, but in addition to increasing the initial cost of the system, it also results in complaints. When a system is over attenuated, the background noise levels become the predominant sounds. These are often intermittent noises and, in many cases, have their sound energy concentrated in a few octave bands. Speech, business machine operation, and other noises related to occupancy are the problems. These are annoying because of their quality or because of the loss of privacy.

For example, consider the case[2] of a legal firm moving into new quarters which had been redecorated and air conditioned. The ventilation noise was virtually eliminated at the firm's request. This firm preferred to work with individual office doors open. Although the offices were carpeted and acoustically treated, conversation could easily be heard from one office to another

[1]*Numerals refer to references on page 156.*



1 TRANSMISSION of speech from office to office through common ducts, door grilles, and openings around piping and other services in otherwise quiet offices may lead to complaints. Noise treatment of ducts and grilles, and sealing of openings will eliminate the problem

because the background noise level was so low. The resulting invasion of privacy was often annoying and embarrassing. In this case, a small amount of ventilation noise would have eliminated the problem.

Throttled Air Valves Solve Problem

In another case[3] in which a privacy complaint was registered in executive offices for essentially the same reason, a suitable background noise level was established by throttling the air valves in the terminal units of the high pressure air conditioning system and increasing the fan speed and horsepower. The higher noise level was primarily due to the increase in pressure drop at the terminal units for delivery of the design air quantity.

Although the fan noise level increased slightly due to the increase in speed and horsepower, the increase in the space noise level because of this would be considerably less than the change at the supply outlets. This is because of attenuation in the duct system and the fact that any increase in the fan noise level must be divided among all of the supply outlets the fan serves. The change made in this system eliminated the privacy complaint. While the interior partitions could have been modified, in this case the changes in the air distribution system were the least expensive solution.

While minimum design criteria have not been established, it is generally agreed[3,4] that the ambient noise levels should not be appreciably less than the criteria heretofore considered the acceptable maximums. These criteria take into account average background noise levels for the type of space involved and attenuation below this is economically unsound and undesirable.

Speech Transmission Through Ducts

Another problem related to privacy, is the cross transmission of speech between offices through the air distribution system. This may be through the outlets of a common supply system (Fig. 1) or through door grilles used in conjunction with corridor returns. When the background noise is low and the duct run between outlets short, a privacy problem may result. It can be eliminated by increasing the attenuation in the supply duct by lining it or by installing package attenuators. Door grilles with built in attenuators are available to reduce noise transmitted through this path. Any other openings between spaces that are introduced by the heating or air conditioning system should be sealed to prevent cross transmission of noise.

Quality Can Be Varied By Design

When it is desirable to vary the character of the background noise to obtain an ear-pleasing result, the distribution system design can be varied to do this. High frequency components can be added by proper selection of the supply

outlets. Low frequency sounds can be attenuated by taking advantage of fundamental data. The following example indicates how this can be done though in this case initial attenuation was of prime importance.

In providing[5] air conditioning for a small portable test room, there was insufficient space available to obtain the desired reduction of low-frequency fan noise by means of sound absorbing devices. To achieve an additional 3 to 5 db of noise reduction at low frequencies, the main ducts to and from the room were split. Thus, there were four small duct openings in the room: two for supply and two for exhaust. These openings were separated by 8 ft. The additional end reflection loss obtained with the smaller duct openings provided the required low frequency attenuation. High frequency attenuation for the system was then provided by placing small packaged sound absorbers in the ducts. The overall result within the room was as predicted and met the owner's requirements without resort to plenums or other space consuming low frequency absorbers.

Some Air System Problems and Their Solutions

Lest the foregoing discussion relax the effort to produce suitable acoustic environments in air conditioned spaces, let's consider some of the problems of too much noise that have arisen, their sources, and how to avoid them. The noisy systems are still more common than those that are too quiet.

In this discussion it is assumed that good practice is followed in the construction and installation of the ductwork as outlined in the ASHRAE *Guide*[6] or the SMACCNA *Duct Manual*[7]. It is essential in both high and low pressure systems that the recommendations for metal thickness, sealing of joints, bracing, etc. be followed to avoid pulsation or "breathing" of ducts, rattles, whistles caused by leaks, and other annoying noises. These recommendations should be embodied in the plans and adequate supervision made to assure that the plans are followed. This is, perhaps, more critical in the high velocity system because noise regeneration is more likely to occur at the high velocities and pressures, but it is essential in the low velocity system too.

Workmanship Is Important

An important factor in the success of any system, workmanship plays an important role in the acoustic performance of the high velocity air distribution system. The following problem illustrates the importance of following recommended practice and some potential sources of noise generation in such a system.

This case[8] involves a multistory office building designed by a leading consulting engineer with an impressive background of successful experience in high pressure, high velocity design. The design was based upon his experience. The round duct, fittings, and sound absorbers were supplied by a fabricator of components for high velocity systems.

When the building was completed and the acoustic performance of the system tested, it was found that a conference room and some adjacent offices had a high noise level. The noise was clearly due to the air conditioning system because the observer's attention was instantly drawn to the outlets and general ceiling area of the ductwork. The noise sounded very much like fan noise. A complaint was registered with the manufacturer that the sound absorbers were not satisfactory.

A series of sound level readings was taken at the points indicated in Fig. 2. The tests before and after the sound absorber absolved it of blame for the noisy condition. The general area of the problem was located when the sound level readings at point C (Fig. 2) were found to be 10 times the level at B. This clearly pointed to a sound regeneration problem.

The consulting engineer continued the investigation in the area pinpointed as the source of the noise. To do this, the suspended ceiling

was removed to permit a complete investigation.

These things were found:

1) The contractor had supplied a fire damper of typical butterfly blade construction. In addition, the blade was of extremely light construction. Butterfly dampers are problems in high-velocity streams with any construction. In combination with the light fluttery blade, the result was vibration and noise. This token fire damper was removed and was replaced with a high velocity damper made of 10 gage metal, with the blade and all operating mechanism out of the air stream. This replacement effectively solved this noise source.

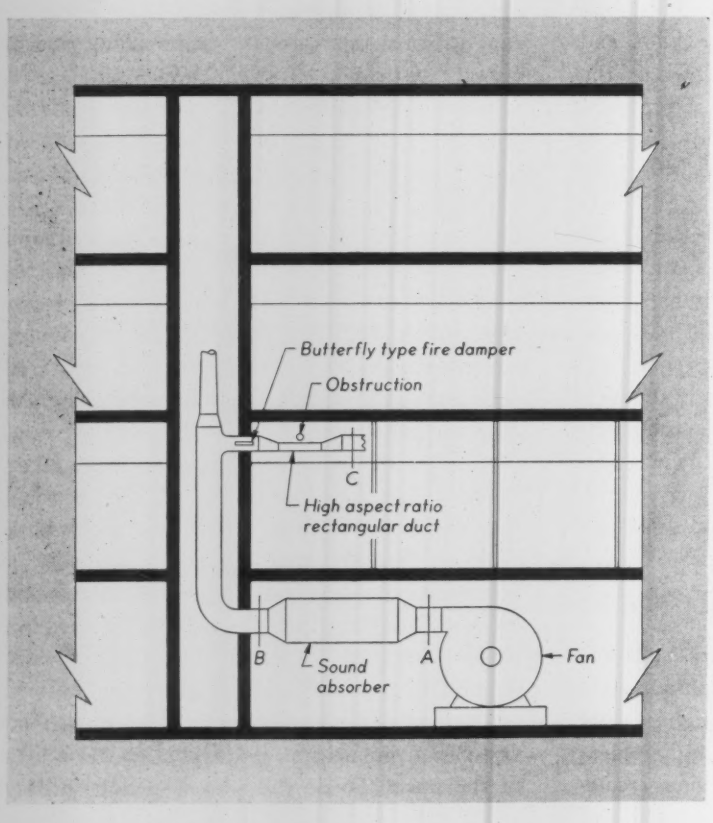
2) The take-off from the riser immediately went into rectangular ductwork. Running this ductwork past all of the interferences required considerable dimensional transformations. In one case in particular, a high aspect ratio rectangular duct section had been used to work under a low clearance area. The designer's requirements for metal thickness and his bracing schedule had not been followed. The large flat side was throbbing and pulsating with the air pressure and generating a lot of noise. With adequate bracing to stiffen this wide face, this source of noise generation was silenced.

3) Other deviations from good practice involved attaching some of the suspended ceiling hangers to the duct (this transmitted vibrations to the suspended ceiling), and hanging or supporting the duct from pipes (this provided a path for duct vibration to travel to other areas). These unsatisfactory items were corrected before the ceiling was restored.

The overall result was a noise level within the range predicted by the engineer. All the problems in this case were due completely to failure to follow the plans in detail.

Other Components Generate Noise

Quantitative measurements of the noise generated by duct system components have been



2 VIBRATION of the butterfly fire damper in the air stream, and pulsation of the high aspect ratio rectangular duct due to improper bracing were sources of annoying noise in this high pressure system. These sources were located by noise level readings at points *A*, *B*, and *C* and by removal of the hung ceiling. Other deviations from good practice included attaching the ceiling to the duct and hanging the duct from the piping, which permitted transmission of noise to remote spaces

A successful noise control design requires: a fundamental knowledge of noise and how it is generated and transmitted, experience, knowledge of other people's problems and how they were solved, and close supervision during construction.

made for relatively few fittings and accessories. Measurement of the noise generated in elbows — one fairly standard component — have been reported only recently[9] for vaned elbows in a limited range of sizes. This noise generation as opposed to that due to poor workmanship is due to the inherent function of the fitting and cannot be eliminated. This requires then that it be taken into account in design and additional attenuation provided where necessary.

• *Elbows*: Noise generated in miter elbows has resulted in one designer[10] avoiding their use in high pressure systems. Results of the recently reported research,[9] confirms the merit of doing this. The results show that elbows will attenuate sound if the input level is greater than the noise generation level due to air flow. Attenuation varies in each octave band and also varies inversely with elbow size. Values range from 0.5 db in the lowest frequency band to a 6 db peak where the elbow size is about one-half wave length. However, the noise generated at velocities around 5000 fpm approaches the noise level of the fan.

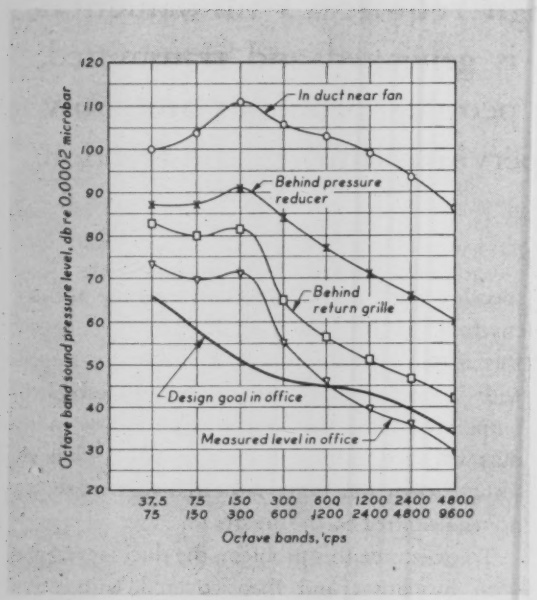
Two problems can arise from this noise generation. The obvious one is the noise transmitted to the conditioned space through the supply outlets. When this noise source is not considered, the attenuation may be inadequate and the noise level too high. The second is that the generated noise will be radiated from the duct surface near the elbow and transmitted to adjacent spaces. If the duct is enclosed by light weight construction such as hung ceilings or furred in spaces which have a low noise transmission loss, the noise level in the space may be excessive.

A good example of this was observed[10] in two adjacent and identical conference rooms served by the same high velocity branch duct. In one, speech communication was easy and the acoustic environment very pleasant. In the other, speech was made difficult by a low frequency rumble with a rather high noise level. Investigation pinpointed the noise source as an elbow in the duct where it entered the noisy space. That the second room was quiet indicated that noise was not transmitted by the air stream.

To overcome this problem, the duct is wrapped with insulation and then covered with metal lath and a heavy coat of plaster where space permits. The plaster is the most important component in this assembly which because of its mass has a relatively high noise transmission loss. Care must be taken to assure that the plaster skin is leak free as even small leaks cause large reductions in its effectiveness. Stiffening of the duct by additional bracing or the use of heavier metal gages is not a solution in such cases since flexing of the duct is not a problem.

• *Terminal Units*: While most of the airborne noise generated in high velocity terminal devices is attenuated in the terminal unit, these too can be radiators of sound that will pass through light weight construction to cause a problem. This source can also be quieted with a plaster cover. Another solution[11] where space permits is to locate the air pressure reducing valves and attenuators along with the high velocity supply ducts in a masonry duct shaft. Solid masonry construction is preferred to poorly-jointed and relatively porous concrete blocks. Every effort should be made to seal the openings between the masonry and the ducts and other services that must penetrate it.

Locating the terminal units in corridor ceilings where possible rather than in the room served is also beneficial.[12] This puts the possible source of radiated sound in the least critical location and provides some additional



3 RETURNS can be noisy too when they are not properly treated as indicated in this plot of noise levels at various points in a high pressure return system. A special attenuator was designed to absorb low frequency sound to meet the design goal. (From "Ventilation System Noise" by H. C. Hardy, *Noise Control in Buildings,* Building Research Institute Pub. 706, with permission)

attenuation of the nozzle noise in the duct connection.

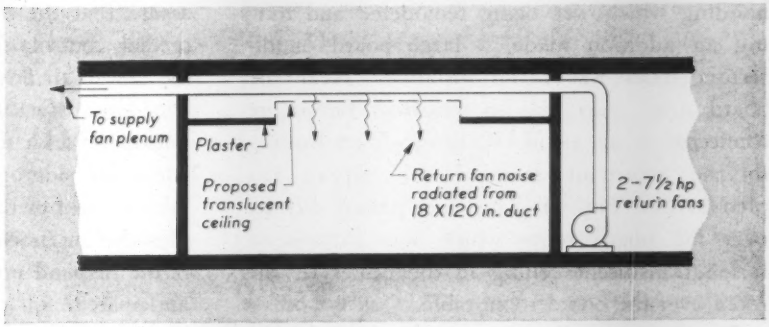
• *Branch Takeoffs*: Here's a potential source of noise that has not been systematically studied but experience indicates that it can be a problem. Butt takeoffs are the worst offenders and especially so when the opening in the header is smaller than the takeoff. The noise is primarily caused by the turbulence due to the abrupt turn. Present practice is to use tapered takeoffs[10,12] which appear to eliminate the majority of the noise problems with low pressure loss as a bonus. An additional precaution taken in a successful design[12] was to limit the distance between successive takeoffs to 8 diameters of the header in which the fitting was located. In this way the air stream in the header is allowed to stabilize after each takeoff. This was one of several factors which were considered effective in producing a quiet high pressure system in a hospital.[13] A rule of thumb used by one equipment manufacturer on fitting placement is that two to three duct diameters[5] must be allowed between any two fittings. Thus, an elbow should not follow a branch takeoff and two elbows should not be put together.

Don't Overlook The Lowly Return

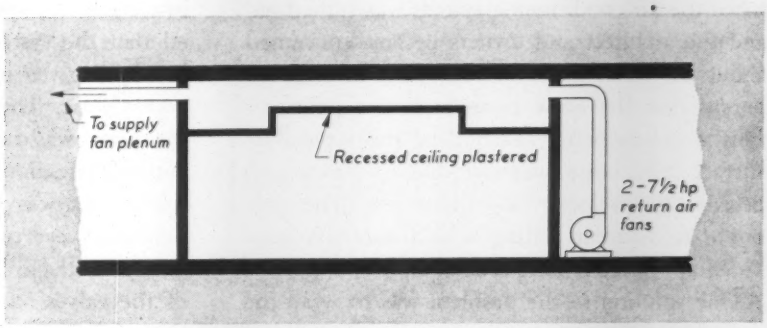
When much design effort is expended to control the noise in the supply air system, especially in the high velocity supply system, the return system may be ignored.[14] Yet, it too is a source of noise even with its normally low velocities. Since the velocity of sound is about 1100 fps, the sound generated by the fan easily travels upstream or opposed to the flow in the return. Little natural attenuation of the fan noise occurs in a large return duct so it is delivered to the return grille face and radiated into the space undiminished in level unless attenuation is provided. Lining the duct in the fan room and, further, if necessary, or the use of package attenuators will eliminate any problem insofar as the noise from the fan is concerned.

• *High Velocity Return Needed Treatment*: A typical noise control problem in a high velocity return system was experienced[2] in a manufacturing office. A large vaneaxial exhaust fan was used in this particular duct system. The static pressure in the branches of the system was controlled by a pressure reducer similar to an air distribution mixing unit. This particular pressure reducer was fitted with a silencing plenum for attenuating the high frequency noise generated by the air flow through it. The noise level in the duct near the fan is given in the upper line of the graph of Fig. 3. These data were calculated by measurements made just outside the outlet of the fan and they are consistent with the predictions one would make from the horsepower and static pressure of this fan. The levels at other points in the system were estimated from available design data and plotted in Fig. 3.

The sound level was reduced[2] to that given by the second line just behind one of the pressure reducers. This reduction of level was mostly due to the change in area from the main duct to that of the branch ducts. There was a small attenuation due to duct absorption. In passing through the pressure reducer, the sound was


To supply fan plenum
Plaster
Proposed translucent ceiling
Return fan noise radiated from 18 X 120 in. duct
2-7½ hp return fans

4a NOISE radiated from return duct in this system before translucent ceiling was installed prompted revision of plans. Solution is shown in Fig. 4b below



4b RECESSED ceiling was plastered and all openings sealed to permit space above ceiling to be used as the return duct. This reduced transmission of return fan noise to an acceptable level

decreased to that given by the third line, and this is the noise which is predicted just behind the intake exhaust grille. When this sound was radiated into the office, it was diffused so that it resulted in the level given by the 4th line, which was actually the data measured in the work space.

From measurements[2] on both ends of the system one can therefore predict very well the attenuation of the sound energy. The design goal for such an office would be "slightly noisy" and is that given by the heavy line. It can be seen that there was excessive low frequency sound in the room. A special resonant absorber to absorb the low frequency sound energy was designed to be inserted in the main exhaust duct to solve the problem.

• *Church Return Noise Stops Service*: A good example of fan noise transmission through the return of a low pressure system was experienced[15] in a church sanctuary. The noise level in the church was so high with the fans in operation that the service could not be conducted unless the fans were turned off. In this system, the main return grilles were located under the rear pews. The header duct serving them extended the width of the building and dropped directly into the plenum serving two return air fans. A damper arrangement was provided to permit expelling the return air outdoors or to the intake of the supply fan. An investigation revealed that the system was handling the design air quantity and also that the fan noise from the return was the offending noise. Lining the return plenum and a portion of the header duct eliminated the disturbing noise.

Noise generation should be considered when selecting return grilles in the same way that it is for supply outlets. The grille should be selected so that its noise output is equal to or slightly less than the criteria for the space in which it is installed. When the return grilles are large and immediately followed by an elbow, turning vanes, of adequate stiffness to prevent vibration, should be installed to provide uniform velocities over the grille face. Turning vanes can be stiffened by tack welding a rod to the leading edge.

• *Return Duct Radiates Fan Noise*: The return duct may also radiate the fan noise to a space through which it passes. For example, in a bank

building which was being remodeled and having an addition made, a large board of directors room was being installed.[5] Near the board room, two 7½ hp return-air fans were connected to an 18 in. × 120 in. duct leading to the return-air side of the supply fan plenum (see Fig. 4). This duct passed directly over the board room which was to have a raised translucent ceiling in the center of the room over the board room table.

The board room had not been completed when the air conditioning system was turned on, and the architect and owners became concerned about the noise level in the room. It was apparent that the noise came from the return-air fans and was being radiated by the large duct surface; the noise was not due to air motion because the velocity was quite low. The proposed translucent ceiling would not have provided appreciable noise reduction.

One solution to the problem was to wrap the duct with some form of insulating material and then cover it with a layer of plaster or sheet metal to form an impervious skin over the duct for the entire length of the board room. Space was not available for this type of treatment so the idea was discarded.

The solution used permitted removal of the entire duct over the board room. All openings in the walls above the ceiling were sealed, as were all openings in the plaster ceiling which surrounded the area which was to have the translucent ceiling. Metal lath hung on grillage to form a raised center area for the ceiling was heavily plastered to complete the sealing. Thus, the entire volume above the ceiling of the board room was used as return-air duct or plenum.

The solution pleased everyone; especially, the architect since it permitted use of a raised plaster ceiling over the board table with cove lighting. As a result, the decor of the room was superior to what it would have been with the translucent ceiling, and the room was free of noise.

Consider Dual Duct System Demand

The selection of the terminal units for a dual duct system must consider both proper air distribution and noise level at the design flow. To assure that the design noise levels are not exceeded, controls should be provided to maintain the design air flow rate lest higher volumes produce unsatisfactory noise levels. The high frequency noises associated with pressure reduction when one side or the other is nearly closed are taken care of by the attenuator in the mixing unit. However, a noise problem may be introduced if the demand on the hot and cold sides is not anticipated.

A case in point was an office building served[16] by a dual duct system. A complaint was registered that the system was noisy though attention had been given in design to controlling the airborne noise. There was no question but what the noise was radiated from the supply outlet and investigation revealed that the hot side of the system was the offender. The system was almost always cooling so that most of the air valves on the cold side were open. Only a few of the valves on the hot side were open at any time, however, so the fan energy to each was much greater than it would be with all of them open. To correct this situation, additional attenuation was provided on the hot side.

The attenuation due to branching is an important consideration as indicated here. How important can be illustrated by considering a system with 10 such outlets with branch ducts of equal area. With all 10 open, the fan energy is attenuated[1] about 10 db in each branch. With only two of the 10 open, the attenuation due to branching is only 3 db. This 7 db difference is sufficient to change a quiet office to an exceptionally noisy one.

Other Sources Too

The preceding discussion has considered several of the more common extraneous noise sources in air distribution systems. There are others that may arise that will be similar in nature and the approach to quieting them would be the same. For example, when a duct passes through a space of high noise level on its way to a quiet office, the noise may be transmitted[17] through the light duct wall into the duct and carried to the office space with unhappy results. This is the reverse of the case where

noise radiates from the duct into the conditioned space but the solution would be the same. A plaster covering with its greater transmission loss would be in order.

Can Vibration Spoil a Design?

Putting the mechanical equipment on the roof has not been without problems in both old and new construction. Unless provision is made to absorb the vibrations of the rotating equipment, much noise can be transmitted to conditioned spaces directly below the equipment room and to rooms at some distance from the source through devious paths in the structure and the piping or duct system.

Perhaps the starting point in the elimination of vibration is providing a stiff or rigid floor on which to mount the equipment. A ground floor has an advantage in this respect, but when a ground floor location is not practicable, the equipment room floor should be stiffened[9] with extra beams. This will virtually eliminate the diaphragm effect due to flexing of the floor. Vibration mounts can reduce but not eliminate the problems that arise from a non-rigid floor.

• *Vibration Isolation Fails on Light Roof Deck*: Consider the case[5] of a recently constructed three-story hospital building, in which a reciprocating refrigeration compressor was installed on the roof. The compressor was a major component of the cooling system for the operating and recovery rooms and was itself located over some of the more expensive private patients' rooms.

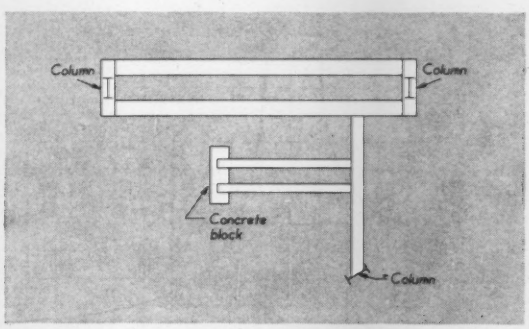
For vibration isolation, the compressor was mounted on standard steel spring isolators. To provide a base for the springs, a 6 in. concrete slab had been poured on top of a lightweight 3 in. roof deck. Unfortunately, this isolation system did not[5] (*and cannot*) work because the roof structure was too light. In a large area under the compressor, it was possible to hear the compressor very clearly. In fact, it was possible to hear the compressor change operation as each of the cylinders loaded and unloaded with changing air conditioning loads.

It would have been possible to design a new isolation system for the compressor, but the consulting engineer felt that the least expensive solution would be to move the entire compressor assembly into an unused space in the basement of the building and repipe the refrigerant to the top floor. The engineer in this case agreed to split the cost of the change with the hospital since he felt that this would be his "tuition" for learning not to locate a compressor on a lightweight roof structure.

Any structure which is required to support machinery on vibration isolators should be quite rigid since in the normal selection of vibration isolators, it is assumed that the bottom of the isolator is on a rigid structure. If the structure is not rigid, it is then necessary to pick vibration isolators which are softer than those which would normally be selected for a rigid base.

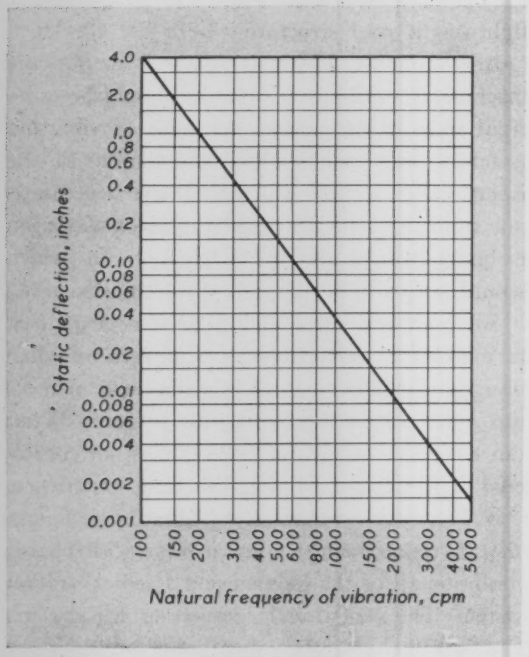
Since all structures deflect to some extent, it is important to consider this deflection when designing platforms to carry equipment in roof-top locations in modernization projects. What can happen if structural deflection is not considered is illustrated by the following experience.

• *Platform Contacts Roof, Transmits Vibration*: In modernizing a hotel, it was decided to air condition all of the rooms using a central station system. The centrifugal compressor for the job was installed in a new penthouse built on the roof of the building. To carry the compressor,



5 PLATFORM above designed for roof top mounting of a centrifugal compressor failed for two reasons; the beams contacted the built up roof, and part of the machine weight was supported by the concrete block on roof

chiller, and condenser, a steel structure was built and attached to the building columns. Two parallel steel beams were run across two existing columns to carry the chiller and condenser as shown in Fig. 5. Another beam was run perpendicular to these two to another column. From this third beam two small beams to support the compressor were installed with one end of each fastened to the beam, and the other end supported by a concrete block on the building roof.



6 STATIC DEFLECTION and natural frequency of a mounting are related as shown here

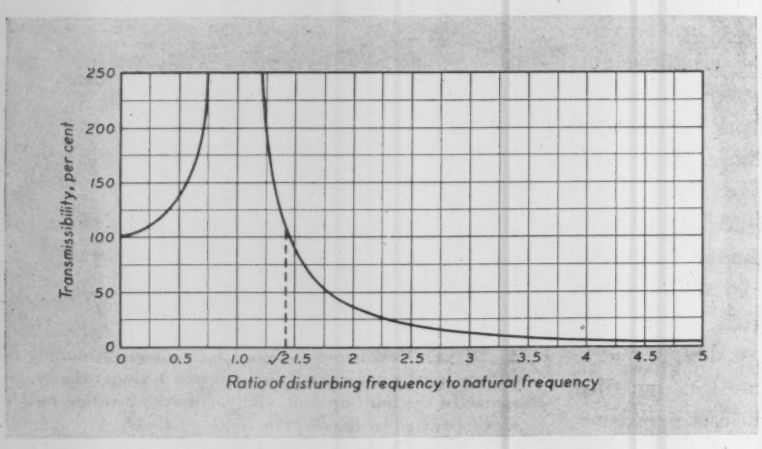
The noise of the compressor was clearly audible in the rooms below the machinery even though ribbed rubber isolators had been installed between the machinery and the steel foundation.

It developed that two mistakes had been made in installing the base for the machinery. First, the steel for the compressor, although tied to the building columns at one end, was actually resting on the roof. Second, the steel under the chiller and condenser was in tight contact with the old built-up roofing instead of clearing it.

To alleviate the noise problem, two things had to be done. A steel beam had to be installed diagonally from the third column to one of the columns carrying the chiller and condenser to pick up the steel under the compressor that had originally rested on the concrete block. Also the tar and gravel had to be cleared from under the steel supporting the chiller and condenser.

The first recommendation was carried out. When it was determined that the beam had a resonance near the operating speed of the compressor, it was recommended that some concrete be added to the base to alter the resonant frequency of the beam and in that way lower the support resonant frequency which would in turn reduce the noise level.

Unfortunately, the final results of this noise study are not known. Using temporary loads on the beam, field tests produced a satisfactory noise reduction. However, the air conditioning contractor was very reluctant to add concrete to the base and was reluctant to remove the old roofing under the chiller and condenser because



7 TRANSMISSION and absorption of vibration vary according to the ratio of the disturbing and natural frequencies as shown here. Transmission greater than 100 percent indicates amplification of the transmitted vibration

of the working space available and the cost.

Vibration Isolation Mountings

A solid foundation alone will not eliminate unwanted vibration; a suitable vibration absorbing mounting is also needed. Rubber-in-shear, cork, and springs are commonly used mountings for fans, pumps, and compressors. The effectiveness of a mounting varies with the ratio of the disturbing frequency of the vibration to the natural frequency of the mounting. The disturbing frequency is that caused by any unbalance of the rotating parts, or pulsations or pressure waves created in the flowing fluid. The disturbing frequency can be measured and should be in critical cases such as large compressors. As a rule of thumb, the rpm of the equipment can be used[18] as the disturbing frequency.

For fans used in air conditioning, two disturbing frequencies should be considered. One[19] is at the fan rpm and is due to the unbalanced forces; the other is at a frequency equal to the rpm times the number of fan blades and is due to the pressure waves or pulsations created by the blades passing the fan outlet. Normal non-overloading fan frequencies run 2000 cpm and up. Forward curved fan frequencies are 6000 cpm and up. For industrial fans that may be subject to the accumulation of dirt or product on the blades and, thus, the increasing of unbalanced forces with use, it is best to consider the critical disturbing frequency as the fan rpm. For fans in precleaned air streams, such as air conditioning fans, it is best to consider the disturbing frequency of the fan blades as the critical design frequency.

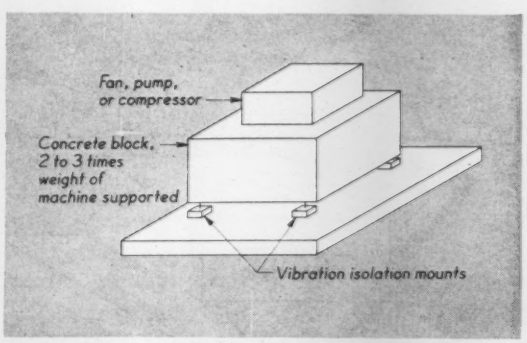
The natural frequency of the mounting depends upon its deflection when loaded in the case of simple linear vibration. The relationship is given in Fig. 6. The natural frequency of any machine on resilient mountings can be determined[18] from Fig. 6 if the static deflection of the mounting is known. Selection of the vibration isolator should be made so its natural frequency is no more than four-tenths of the disturbing frequency or, conversely, the ratio of disturbing frequency to natural frequency should be greater than 2.5.

The efficiency[18] of a vibration isolation system can be determined from Fig. 7 when the disturbing and natural frequencies of the system are known. This gives the percentage of vibration transmitted to the structure as a function of the ratio of these two frequencies. For example, for the ratio of 2.5 recommended above, 20 percent of the vibration is transmitted or conversely, 80 percent is absorbed. It should be noted that for ratios less than the square root of two, the vibration is amplified (transmission is greater than 100 percent) with the greatest amplification occurring at resonance or when the ratio of the two frequencies is 1.0.

When springs are used for vibration isolation, provision should be made to isolate them from the foundation. Neoprene or rubber pads are often used for this purpose. This is necessary to prevent transmission of high frequency sounds along the spring. Rubber-in-shear isolators should not be used where oil may cause deterioration of the rubber and, thus, decrease their effectiveness.

"Inertia Bases" Improve Isolation

To limit the movement of fans, pumps, and compressors due to vibration when passing through critical disturbing frequencies during start-up and also at normal running speeds, "inertia bases" so-called are necessary. This movement depends upon the unbalanced forces and the weight of the machine. Movement is decreased by decreasing the unbalanced forces or



8 INERTIA BASE comprised of a concrete mass 2 to 3 times the weight of the machine supported improves vibration isolation by limiting movement of equipment. Fan, pump, or compressor is mounted on concrete which in turn is mounted on vibration isolation mountings

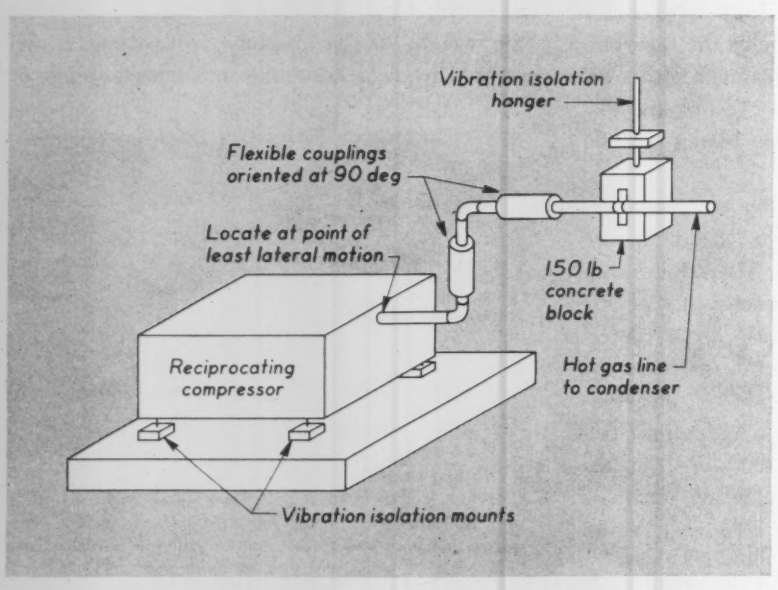
by increasing the mass of the machine. The first step to eliminate movement then is the use of accurately balanced equipment. Both static and dynamic balance must be considered. Since not all of the unbalance can be eliminated and since the balance changes during the operating life of the equipment due to normal wear, accumulation of dirt and scale, etc., the mass of the system may be increased to improve the overall and long term quality of vibration isolation. This is the purpose of the "inertia base" which consists of a concrete block on which the equipment is mounted (see Fig. 8). The concrete block in turn is mounted on vibration isolators resting on the floor or foundation. The concrete block increases the mass of the equipment without changing the unbalanced force and, thus, improves vibration isolation. The concrete base should weigh from 2 to 3 times as much as the machine it supports for best results. The concrete mass will also absorb much of the noise transmitted to the floor through the vibration isolators. Inertia bases have been used[11,14] for pumps and fans in high pressure air systems with considerable success.

Isolate Ducts and Piping Too

Ducts and piping are excellent paths of noise transmission that can carry noise generated by fans and pumps through well conceived equipment room walls to occupied spaces unless suitable flexible couplings are installed. Duct walls can carry fan noise and vibrations which may be amplified[11] before being radiated to the conditioned spaces. A flexible connection near the fan outlet can minimize, if not eliminate, this potential source of trouble. Flexible duct connections at strategic points outside of the machine room can eliminate noises related to expansion and contraction of the duct system due to changes in supply-air temperature.

In piping systems, the transmission of pump or compressor noises and vibration can be achieved by installing flexible connections between the machines and fixed piping. Reinforced, wrapped fabric sections of rubber pipe commonly used on water lines also reduce fluid-borne noise transmission and absorb water hammer shock, in addition to reducing structural-borne noise transmission. Further isolation of the piping system can be obtained through the use of vibration isolation hangers in the machine room.

An example of how a piping system was quieted will illustrate some of the ways in which piping systems may transmit noise to otherwise quiet spaces. In this case,[17] investigation revealed that two 50 hp refrigeration compressor assemblies were the source of excessive noise in an ex-


Vibration isolation hanger
Flexible couplings oriented at 90 deg
Locate at point of least lateral motion
150 lb concrete block
Reciprocating compressor
Hot gas line to condenser
Vibration isolation mounts

9 VIBRATION of a 50 hp reciprocating compressor transmitted by the hot gas line through the structure to executive offices below was eliminated by installation of flexible connections, vibration isolation hangers in the machine room, and an inertia block as shown here

ecutive office immediately below the rooftop equipment room. Operating the whole system, and then only the air system indicated that the compressors were the source of the noise. Comparison of the measured noise reduction with that estimated for airborne noise indicated further that the noise was transmitted through the structure. The compressor assemblies had been properly installed on suitable vibration isolation mounts, but the hot gas lines were rigidly attached to the floor and walls of the machine room. To reduce the noise transmission to the occupants satisfaction, the following steps were taken:

1) Two flexible couplings oriented at 90 deg to each other were installed in each hot gas line as shown in Fig. 9. This gives improved vibration isolation[17] over a single coupling. Another important consideration here is attaching the coupling nearest the compressor as close as possible to the center of motion of the unit or at the point of least lateral motion of the assembly.

2) A heavy mass of 150 lb was attached to the line beyond the second coupling. This serves[17] the same function as the "inertia base" and reduces transmission of the compressor vibration to the piping.

3) The weighted hot gas line was supported from the equipment room ceiling by means of suitable vibration isolation hangers. This provided a vibration break[17] in the support and also lengthened the path of any structure-borne noise and vibration to the offices below.

In summary, flexible connectors should be installed[5] close to all fans and pumps before any ducts or pipes are connected to the building. Electrical lines between rotating machinery and conduit fixed to the structure should also be flexible. It is essential that all connections between the machinery and the building be flexible so there is no rigid connection which will short circuit the vibration isolation.

Bottle Up Equipment Room Noise

When equipment rooms must be located adjacent to private offices or other spaces that require low noise levels, provision must be made to minimize noise transmission through floors, walls, or ceilings as the case may be. As noted in earlier sections, reduction in noise transmission is best accomplished by massive and relatively air tight construction. Heavy masonry construction transmits little sound as compared with light frame construction. In general, walls are less effective in isolating low frequency noises than they are in isolating high frequency noises. Thus, for minimizing transmission of the low frequency noises associated with fan rooms, a heavy concrete or brick wall is needed. Sound insulating characteristics of various types of construction are given in Reference 20. This may prove helpful in determining the type of walls or ceilings needed for a particular isolation problem. Care should be taken to seal air spaces between the walls and any services that penetrate them. Also, gasketed equipment room doors may be needed to prevent airborne transmission of fan room noise.

Architect, Engineer Cooperation Needed

It is particularly evident in the case of equipment room isolation and, also in several situations described earlier, that close coordination of the architectural and mechanical system designs is essential from the standpoint of noise control. Coordination is as essential in providing the least expensive and most successful acoustic design as it is in providing proper control of the other environmental factors. The location of quiet offices with respect to the equipment rooms, acoustic treatment of the conditioned spaces, and the type of partition selected, among other things, have an appreciable influence on the acoustic phase of the mechanical system design. Balancing the two designs will optimize the solution to noise control problems.

Is There a Practical Limit of Control?

While it is desirable to control as many potential noise sources as possible in the design stage, it may not be economically practical to do so. At some point, it is often desirable to take a calculated risk[14] and defer corrective measures — if they prove necessary — until the performance is checked and occupant reaction obtained. Obvious sources of noise should, of course, be controlled. It is only the marginal problems of unpredictable severity that can or should be deferred. This requires considerable *engineering judgment,* and *agreement* on the part of the client to take the calculated risk where such marginal problems exist. When doubt arises as to the extent of treatment required, consultation with an acoustical engineer familiar with mechanical system noise control problems will prove advantageous.

The relationship with the client is important here and he must fully understand that the savings in initial cost are obtained only at the possible later expense for corrective measures. As a general rule, corrective measures are more expensive to make once a system is in operation. But even so, the cost of additional noise control measures can be considerably less than the first cost of attempting to control every potential source of noise providing the main sources have been quieted.

A good example of this was experienced[14] when an existing office building containing several thousand offices was air conditioned. Precautions were taken in design to control the noise generated by the principal components of the high pressure, dual duct system that was installed. At some turns and branching points, it was anticipated that a problem might arise though this could not be quantitatively predicted. The owner was informed of the various alternatives and their potential costs and agreed to make such corrections as might be needed after the system was in operation knowing that a savings in initial cost was made. The fact that only one of the several thousand offices was a problem is evidence of the good judgment of the consulting engineer and the careful design made to quiet the major components of the system. The only annoyance was due to radiation of sound from a main duct which made two turns adjacent to an executive office. The problem was solved by moving the executive to a new office and, in turn, utilizing the abandoned space for a function in which the higher background noise levels were acceptable.

[The editors wish to acknowledge the assistance given in the preparation of this report by the several engineers who contributed information from their experience, those who reviewed the report, and the organizations who permitted reference to their papers and the use of figures contained therein.]

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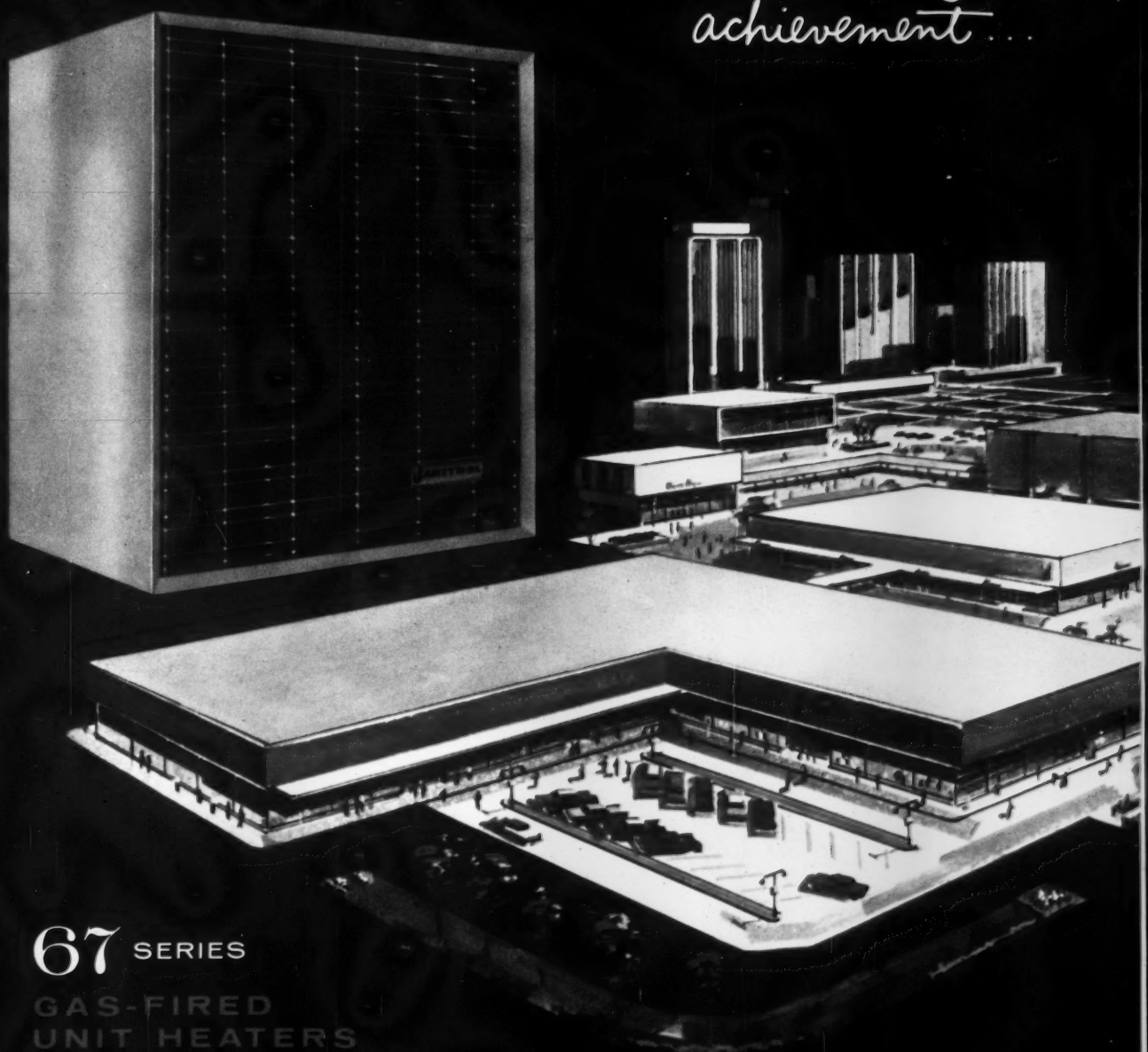

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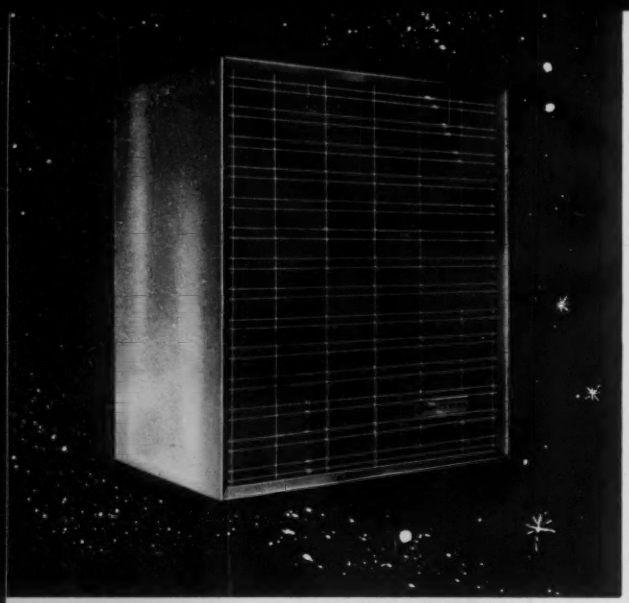

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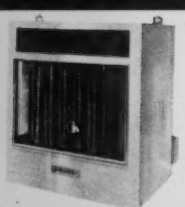

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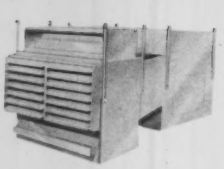
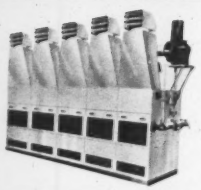
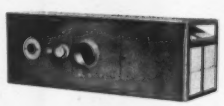


BLOWER-TYPE UNIT HEATER
Allows air delivery from greater heights and against greater static pressures. Models with exposed or enclosed blowers. A.G.A. approved as low and high static-type blower unit heater for air delivery to duct system up to 1.0 in. W.C. external static. Heat sections factory assembled. Sizes: 300,000, 400,000 and 500,000 Btu/hr. input.

FLOOR-TYPE UNIT HEATER
Cold air drawn from floor level is heated, filtered and discharged horizontally overhead. Quiet, clean, carefree—ideal for offices, restaurants, stores, labs, etc., requiring a compact unit.



HEAVY DUTY BLOWER HEATERS
For unit heating, central heating and air conditioning. Wide range of standard blowers and motors assures correct air delivery and temperature rise in each application. Factory assembled and tested. Capacities from 250,000 Btu to 1,750,000 Btu/hr. input.



HORIZONTAL OIL UNIT HEATER
For suspension overhead. Saves floor space. Compact, efficient, low-maintenance design clean and quiet in operation. May also be used to feed duct system. Choice of sizes from 84,000 to 250,000 Btu/hr. output to meet all needs.

helpful data for
ARCHITECTS, CONTRACTORS AND ENGINEERS
write collect today for complete information on Janitrol units for heating with clean, economical gas in buildings of every type. There's no obligation.

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HEATING AND AIR CONDITIONING
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Also Makers of Surface Industrial Furnaces, Kathabar Humidity Conditioning, Janitrol Residential Heating and Cooling Equipment.

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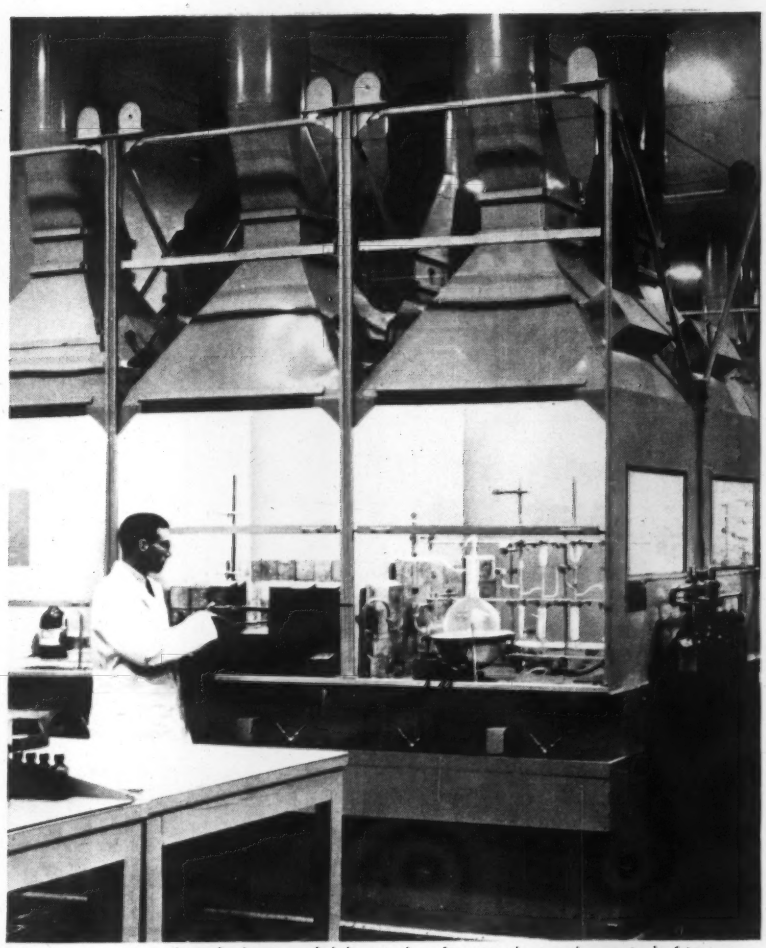

Delicate experiments in today's research laboratories often require precise control of temperatures and humidity. Air-conditioning plays an important role in modern research, protecting equipment from atmospheric variations and helping scientists work in top form.

Summer reading soars in libraries that install air-conditioning. Scholars and browsers alike escape the heat, and the books are guarded from dampness.

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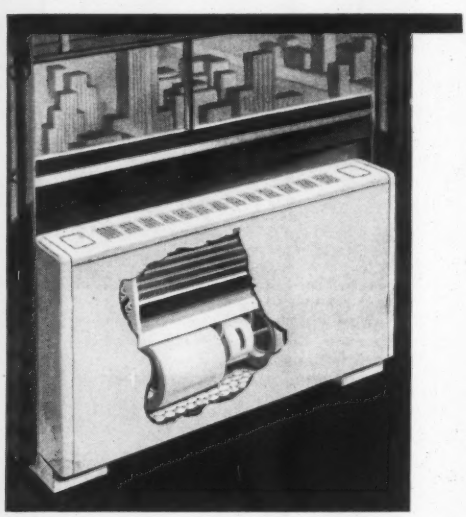
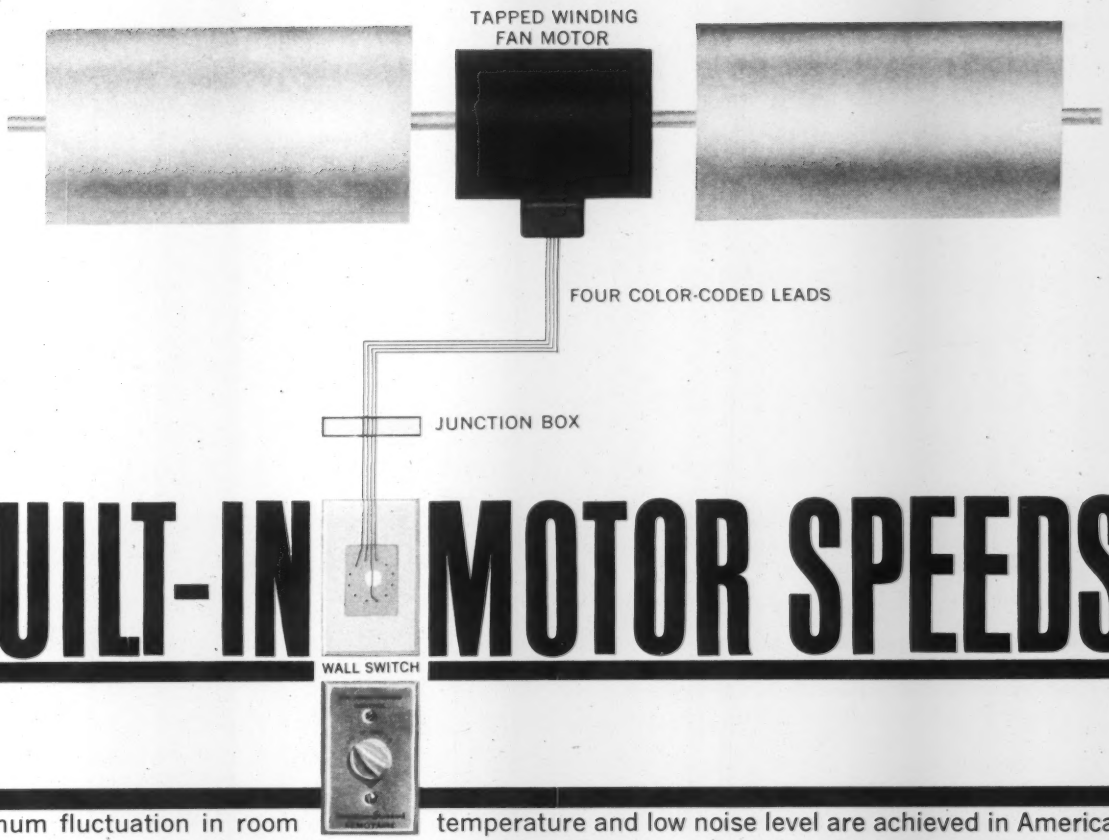
EXCEPTIONAL SPEED REDUCTION GIVES SUPERIOR HEATING PERFORMANCE IN FAN COIL UNITS . . .

TAPPED WINDINGS PROVIDE



CUTAWAY OF REMOTAIRE ROOM UNIT SHOWING MOTOR AND FANS



BUILT-IN MOTOR SPEEDS

Minimum fluctuation in room temperature and low noise level are achieved in American-Standard Remotaire year 'round units by use of long-cycle, low-speed fan operation. Tapped winding motors, carefully matched to the operating characteristics of each size unit in the line, give an approximate 50% reduction in air volume at low speed (600 rpm). This fan-speed reduction assures long-cycle, even heating; a primary contribution to room-occupant comfort. ■ Three built-in motor speeds (with four simple color-coded leads) provide complete operating flexibility through individual unit fan-speed control. No need for external regulating devices such as autotransformers or reactors, potential sources of noise and extra servicing. Wall switch is the same size and shape as a standard light switch. ■ Test-rated Remotaire fan-coil units, both Type 20 (vertical) and Type 30 (horizontal), are part of a hydronic* year 'round air conditioning system. Controls, boilers, chillers and other equipment available from American-Standard in many types and sizes. ■ For complete information contact an American-Standard representative or AMERICAN-STANDARD PLUMBING AND HEATING DIVISION, 40 West 40 St., New York 18, N. Y. *Hydronics: the science of heating or cooling with water

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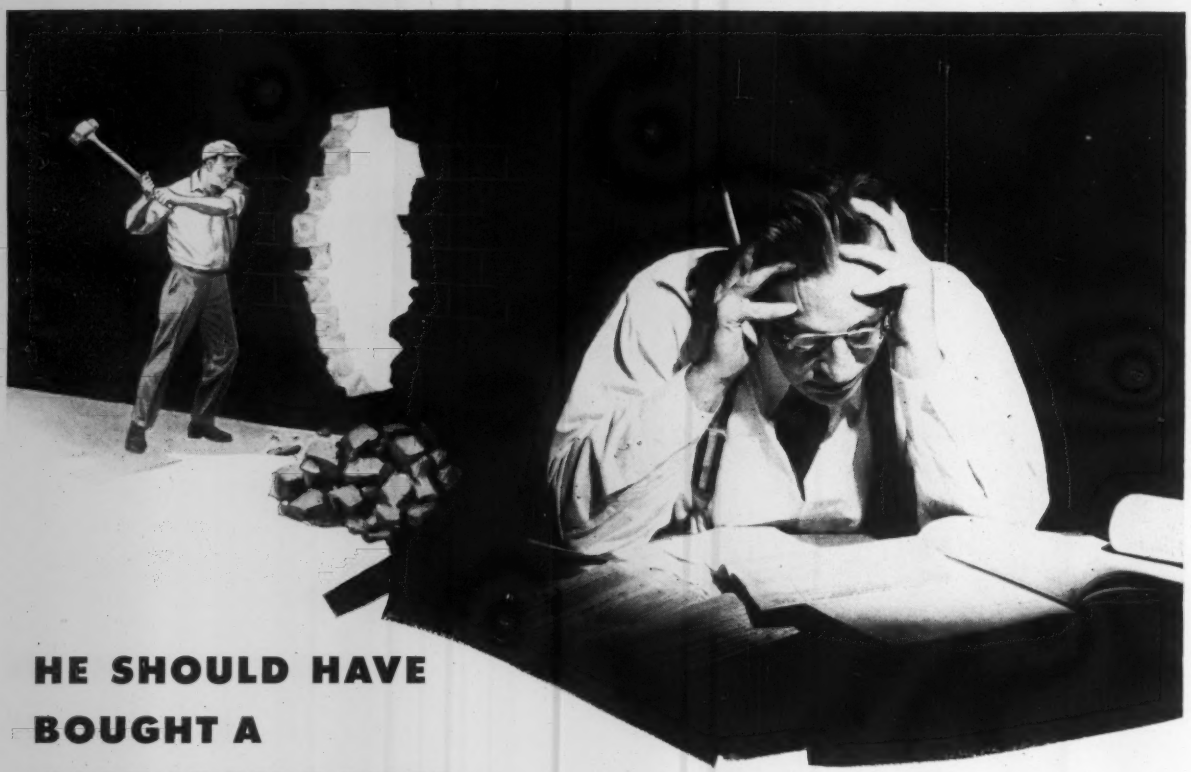
American-Standard
PLUMBING AND HEATING DIVISION



HE SHOULD HAVE BOUGHT A *CAST IRON* BOILER

...THE KIND THAT GOES THROUGH AN ORDINARY DOOR...NOT A HOLE IN THE WALL

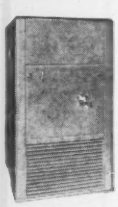
Where greater heating capacity may be a future need, it's only horse sense to install a boiler which can meet the new demand with least trouble and expense.

The sections and base of any Weil-McLain Boiler can be passed through an ordinary door. In existing buildings, boiler capacity can be increased by adding sections or bringing in a complete new boiler...*with no structural alterations needed.* In new buildings, boiler installation can wait until the job is under roof.

Weil-McLain Boilers offer these additional *extra values*... less boiler room space...corrosion-resistant cast iron construction...tested and rated by I-B-R...strain-free assembly with short draw-rods...design integrated with burner...easy maintenance.

Weil-McLain Cast Iron Sectional Boilers for commercial and industrial installations are available for gas, oil, heavy oil, combination gas—light oil or coal. For gas and oil boiler information, write to Weil-McLain Company, Michigan City, Indiana. Current oil boiler information is also available in Engineer's Product File and Sweet's Architectural File.

When installing or adding capacity to a Weil-McLain boiler, sections and all components can be moved through an ordinary doorway.



FOR GAS
Net ratings to
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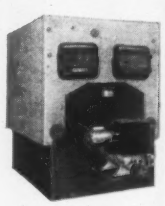

FOR OIL
Net ratings to
2,942,500 BTU/hr.

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CAST IRON BOILERS

Address literature requests to Dept. AA-80

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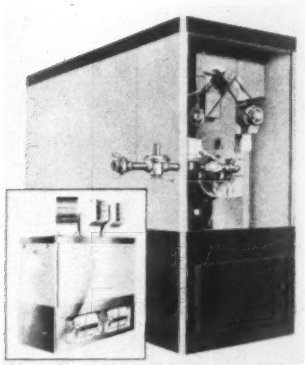
EQUIPMENT DEVELOPMENTS

Information on capacities, dimensions, applications, and special features in each item is presented in accordance with material furnished by the manufacturers, who may be contacted directly for more details. For reviews of Recent Trade Literature see page 198

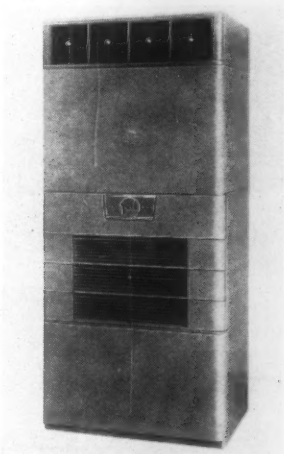


Industrial Heater . . .

. . .for duct connection as central heater, or with directional discharge nozzles for up, down, or horizontal delivery; gas or oil fired with single burner assembly and manual or automatic selector switch; has cylindrical stainless steel primary heat exchanger surface, aluminized steel tubing secondary surface; with mechanical atomizing type, direct spark ignition oil burner, and inshot type gas burner with interrupted spark igniter; induced and forced draft blower assembly is belt driven by ¾ hp motor, is furnished as unit with heat exchanger or separately; in two models for 750,000 or 1 million Btu per hr output — *Lennox Industries Inc., Marshalltown, Ia.*

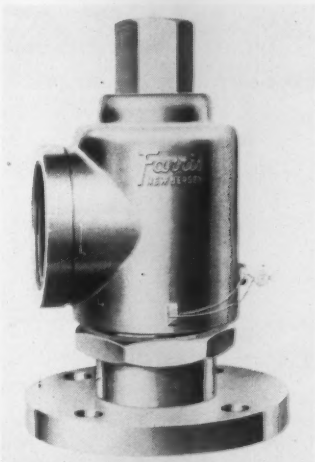
Industrial Adhesives . . .

. . .epoxy resin, cure at room temperature under contact pressure in about 7 days, faster when heat is applied; of three types, each maintains strength properties over temperature range of −170 F to 160 F with shear strengths from 2300 to 3200 psi at 75 F; for metals and plastics, adhesives offer resistance to water, hydraulic oil and aromatic fuels; designated EC-1751, EC-1838, and EC-2054 — *Minnesota Mining and Mfg. Co., Adhesives, Coatings, and Sealers Div., 900 Bush Ave., St. Paul 6, Minn.*



Air Conditioners . . .

. . .summer, for commercial applications offered in line which includes 6 outside air cooled condensing units with capacities from 4.7 to 15.7 tons, with inside coil sections in self-standing, suspended, plenum, or duct-connected models; with "low-ambient" feature affording operation in less than 60 F outside temperatures; variety of remote-inside combinations available, models feature twin blower wheels, hermetic compressors — *York Div., Borg-Warner Corp., Roosevelt Ave., York, Pa.*



Relief Valve . . .

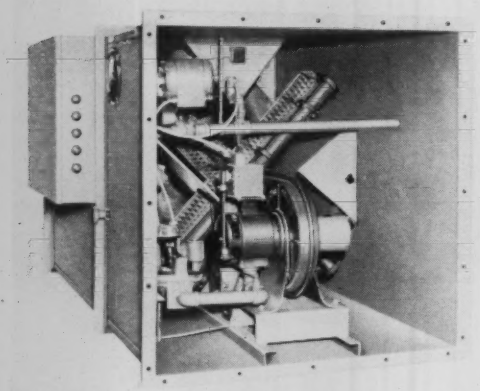
. . .for liquid, gases, and vapors in 300 psi maximum pressure applications; with one-piece stainless steel body and stainless steel disc to assure leakproof seating without use of other joints or gaskets; available with tungsten steel springs for temperatures up to 800 F, choice of plain cap, packed cap and lever, or open lever, male screwed or 150 and 300 lb flange inlet connections — *Farris Engineering Corp., 563 Commercial Ave., Palisades Park, N.J.*

Plastic Tubing . . .

. . .for use with pneumatic tools, process air hose operations, is available in ¼ in. ID and ½ in. OD size with working pressure of 150 psi; nylon tubing for pressures up to 250 lb also available, has ⅛ or ¼ in. ID — *The DeVilbiss Co., 300 Phillips Ave., Toledo 1, O.*

EQUIPMENT DEVELOPMENTS

Continued

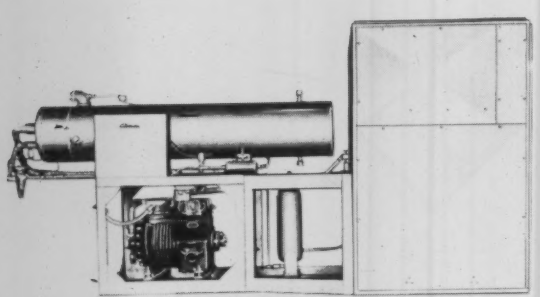


Make-Up Air Heaters . . .

. . . gas fired, in four sizes, 1 to 7 million Btu per hr, 15,000 to 90,000 cfm; basic units include burner, controls, and belt or direct drive fan plus optional turning elbows, shutters, filter housing, and outlet diffusers; control systems available to meet various operational and code requirements — *Hartzell Propeller Fan Co., Piqua, O.*

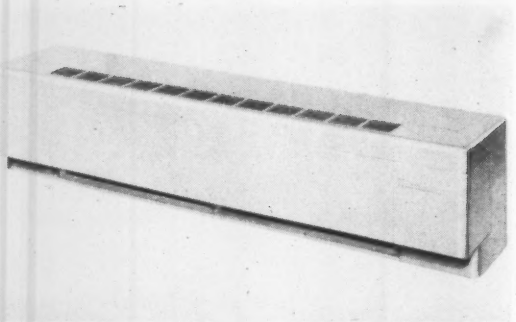
Portable Ventilators . . .

. . . for fume exhaust or air circulation in areas lacking permanent installations, combine portable fan with lengths of flexible duct; 16 in. propeller model has 1-½ hp motor, delivers 4150 cfm; 12 in. model available with 1/3 or 1 hp motors, for 1540 or 1935 cfm air delivery; units available with single or three phase motors with sealed bearings for mounting in any position — *Propellair Div., Robbins & Myers, Inc., Springfield, O.*



Packaged Liquid Chillers . . .

. . . in six models, 8 through 30 ton capacities, are equipped for operation with water cooled, evaporative, and air cooled condensers; units are completely factory assembled, require only power and piping connections at site — *Crane Co., 836 S. Michigan Ave., Chicago 5, Ill.*

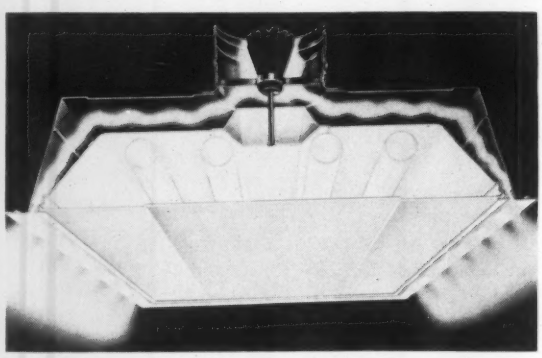


Fan Coil Unit . . .

. . . featuring low silhouette design is 14½ in. high, designed for free-standing installation before low windows to receive hot or chilled water from central source; pipes, drain and electrical service lines positioned above floor level for ease of installation in new or existing structures; features multi-speed motor control, disposable filters, "leak-proof" coils, choice of cabinet colors; available in four lengths from 44 to 96 in. — *Modine Mfg. Co., 1500 DeKoven Ave., Racine, Wis.*

Horizontal Pumps . . .

. . . centrifugal, in single and multi-stage models for fluid temperatures up to 350 F; all models cast in ductile iron, with split case design; single stage unit available in sizes of 4 in. and larger for capacities to 60,000 gpm at discharge heads up to 400 ft; two, three, four, or five stage models have capacities up to 3000 gpm at heads to 1500 ft; may be used with any type drive, bulletin "B-134" available upon request — *Peerless Pump, Hydrodynamics Div., Food Machinery and Chemical Corp., 2005 Northwestern Ave., Indianapolis, Ind.*



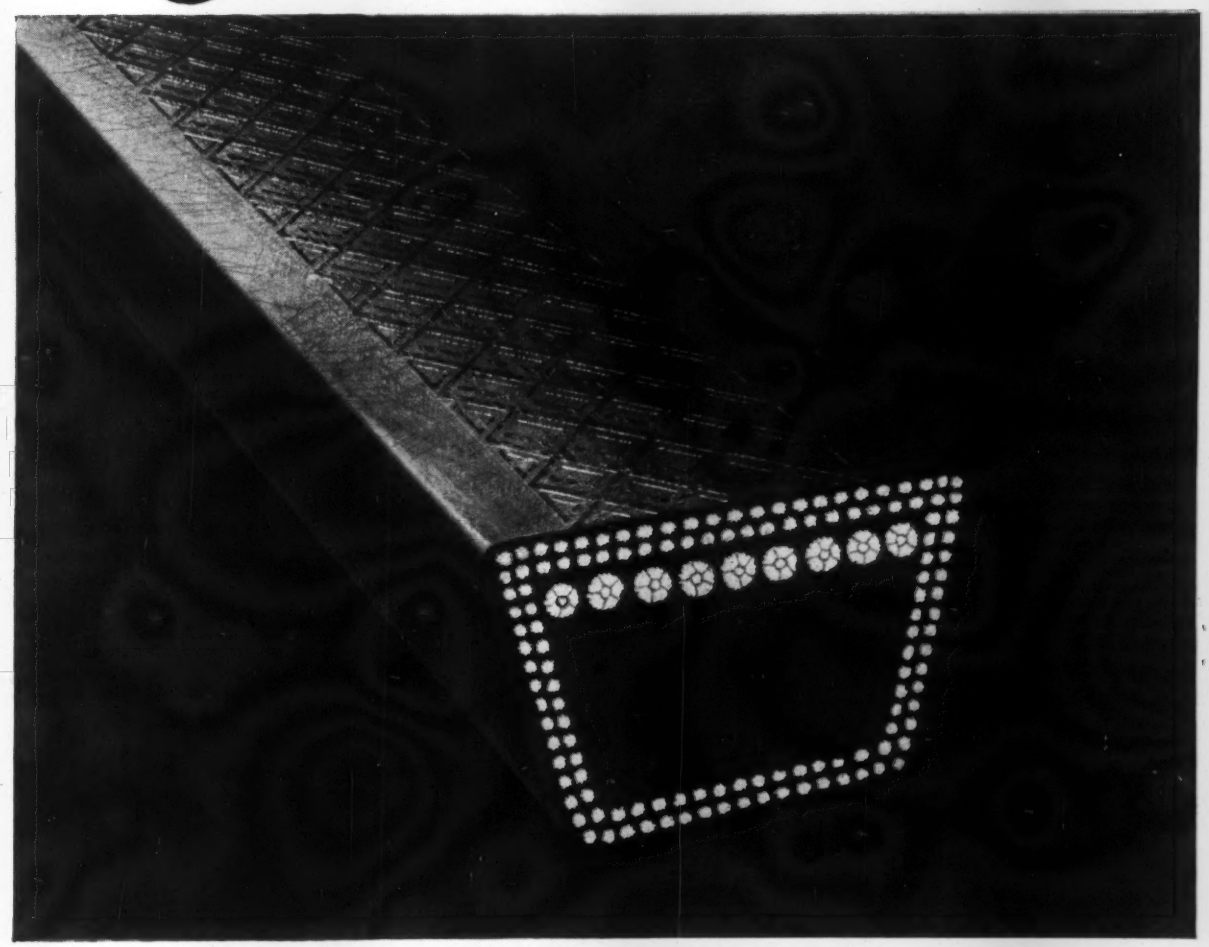
Combination Diffuser-Light . . .

. . . available in 12 × 48 in. or 24 × 48 in. sizes with fluorescent lamps, choice of lighting enclosures including louvers, plastic, and glass; perimeter air diffuser aperature is separated from light chamber by double wall construction; 5 in. diameter duct accommodates top or side inlet extension, has integral damper; catalog "F-9768" available upon request — *Barber-Colman Co., 1701 Rock St., Rockford, Ill.*

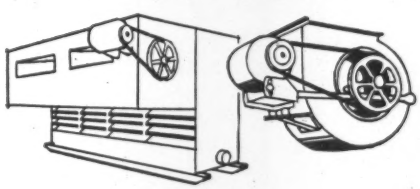
US RUBBER

AUTO AIRCON STEEL CABLE V-BELTS
from the Power Unlimited complete belt line

Patented curing method keeps all the steel pulling members in the same plane. They remain straight, are never wavy.



Quiet...smooth... vibration at the vanishing point



For silent and efficient operation of fans, pumps, compressors, blowers—for best power transmission in air-conditioning and refrigeration units—specify U. S. Auto AirCon Steel Cable V-Belts. These belts have everything required in a belt for air-conditioning use. They are in a class by themselves. Forget your negative experiences with other V-belts. U. S. Auto AirCon V-Belts have pulling cords of steel. A new, patented curing method and electronic tensioning of the steel cords *free this belt from vibration*. Power is transmitted smoothly, quietly, efficiently. It has been proven in rugged, automotive air-conditioning service. This belt has outlasted other belts up to 2½ times longer.

Our transmission engineers stand ready to consult with you on any and all transmission belt problems. Drop us a line at the address below.

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- Funneled inlet for improved fluid flow.
- Bonding surface at least 3 times the pipe or tubing thickness: result—joint stronger than pipe.

SAVES on UNIT PRICE compared with reducing tees

SAVES on fabrication time

SAVES on silver brazing material

PROVIDES branch joint stronger than the run pipe

PROVIDES piping system with less potential leaky joints

PROVIDES streamlined piping system, outside and inside

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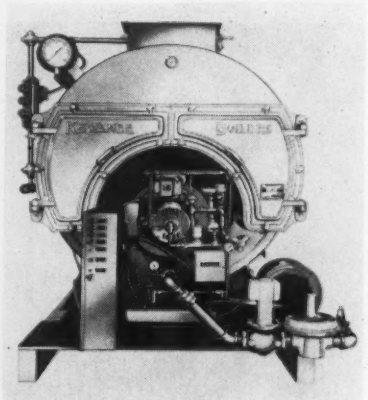
"Brazolet installation on U. S. Navy ship piping"

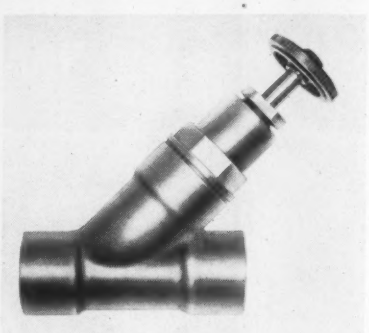
BONNEY FORGE and TOOL WORKS
ALLENTOWN, PENNSYLVANIA

EQUIPMENT DEVELOPMENTS
Continued



Packaged Boilers . . .

. . . "Kewanee" Scotch-type forced draft, 83 to 691 hp at 15 psi steam or 30 psi water pressures, 82 to 672 hp at 125 or 150 psi steam; fire natural gas, oil, or combination, integral burners and controls are factory mounted; feature roller expanded tube ends, cast iron flue doors with quick-release clamps, front mounted controls, electric oil preheater with cast aluminum reservoir — *American-Standard Industrial Div., Detroit 32, Mich.*

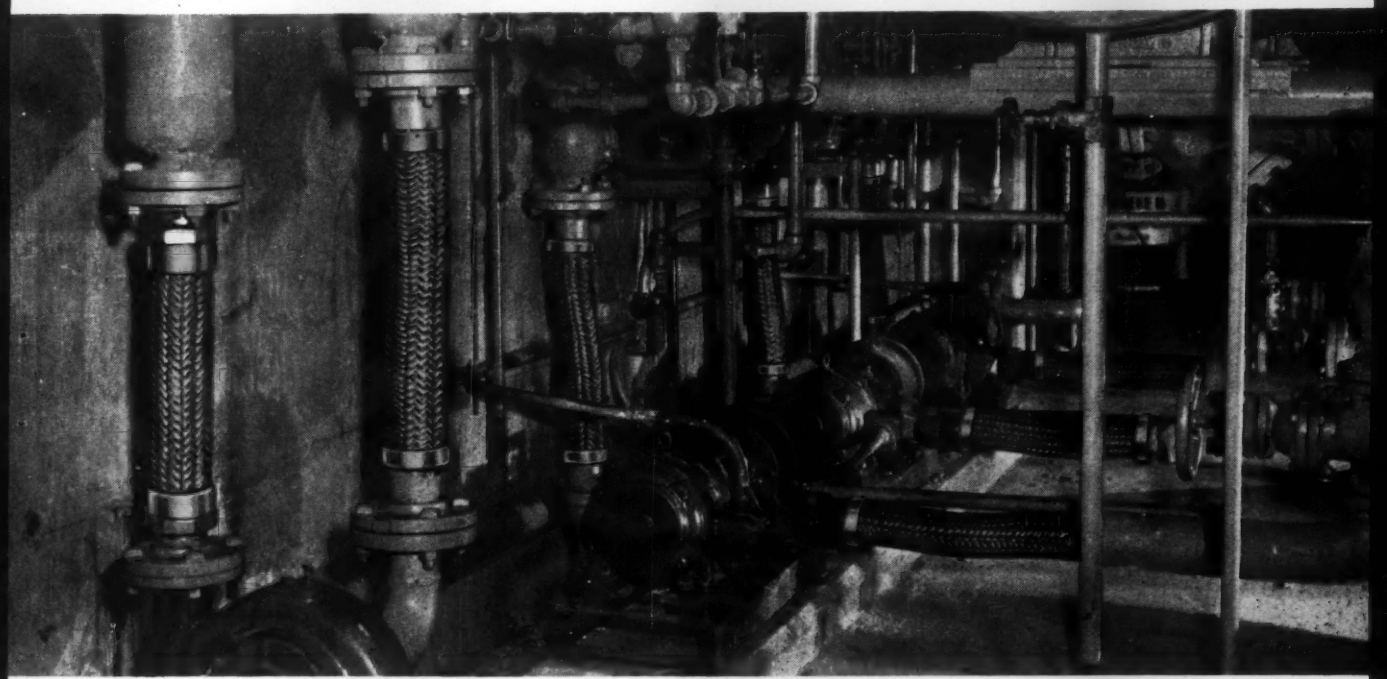


Plastic Globe Valves . . .

. . . PVC, in 1½ through 3 in. size range for 125 psi service at 145 F, available with screwed or socket-weld ends; for use in systems handling acids, alkalies, chemical salt solutions, etc., are chemically inert, light weight, with smooth interior bores; stems are set at 45 deg angle to minimize flow turbulence; valve back seats in open position to allow repacking under pressure — *Dorak Products Corp., 78 Pearl St., New York 4, N.Y.*

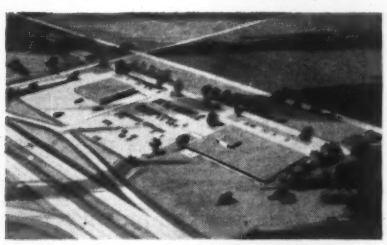
APPLICATION HINTS:

Ways to simplify construction and cut costs with Flexpipe



Six Flexpipe connectors, 2½" I.D., 24" long, at the three boiler feed pumps. In the foreground are the Flexpipe connectors at the hot water pump feeding Weathermaster units throughout the Administration Building of the Illinois State Toll Highway Commission.

Flexpipes made this heating and cooling system more compact, cut installation time



Artist's rendering of the Administration Building, Illinois Toll Highway Commission. Lankton, Ziegele, Terry & Associates: Architects and Construction Engineers.

Heating and cooling systems can utilize all the advantages offered by Flexpipe connectors. Flexpipes take up movement caused by expansion and contraction in piping from wide variations in temperature. At the same time, they absorb vibration and dampen noise from pumps.

They make possible better utilization of space because they are easier to install in tight quarters and can handle offset. Note in photo above how vertical Flexpipes from boiler feed pumps saved space by making possible easy connections to piping flush against wall. Conventional piping would require considerably more work room—plus the time and cost of installing elbows, couplings, short runs of pipe, etc.

Flexpipe's flexible core can be either bronze, galvanized steel or stainless steel—I.D.'s range from ¼" through 16".

WHERE TO BUY: Leading wholesaler distributors can provide you with information about Flexpipe in standard sizes. For the name and address of the distributor serving your area, or for more detailed information, write to: Anaconda Metal Hose Division, The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

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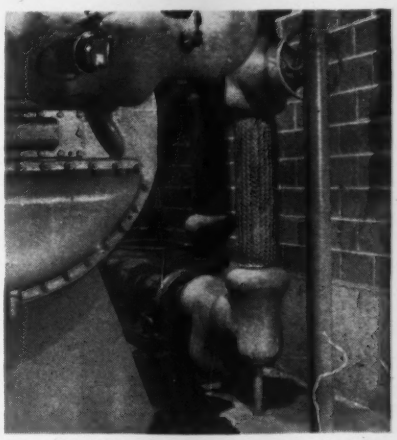

Two 8" I.D. Flexpipe connectors handle cooling water for refrigeration unit.

Flexpipe®

an

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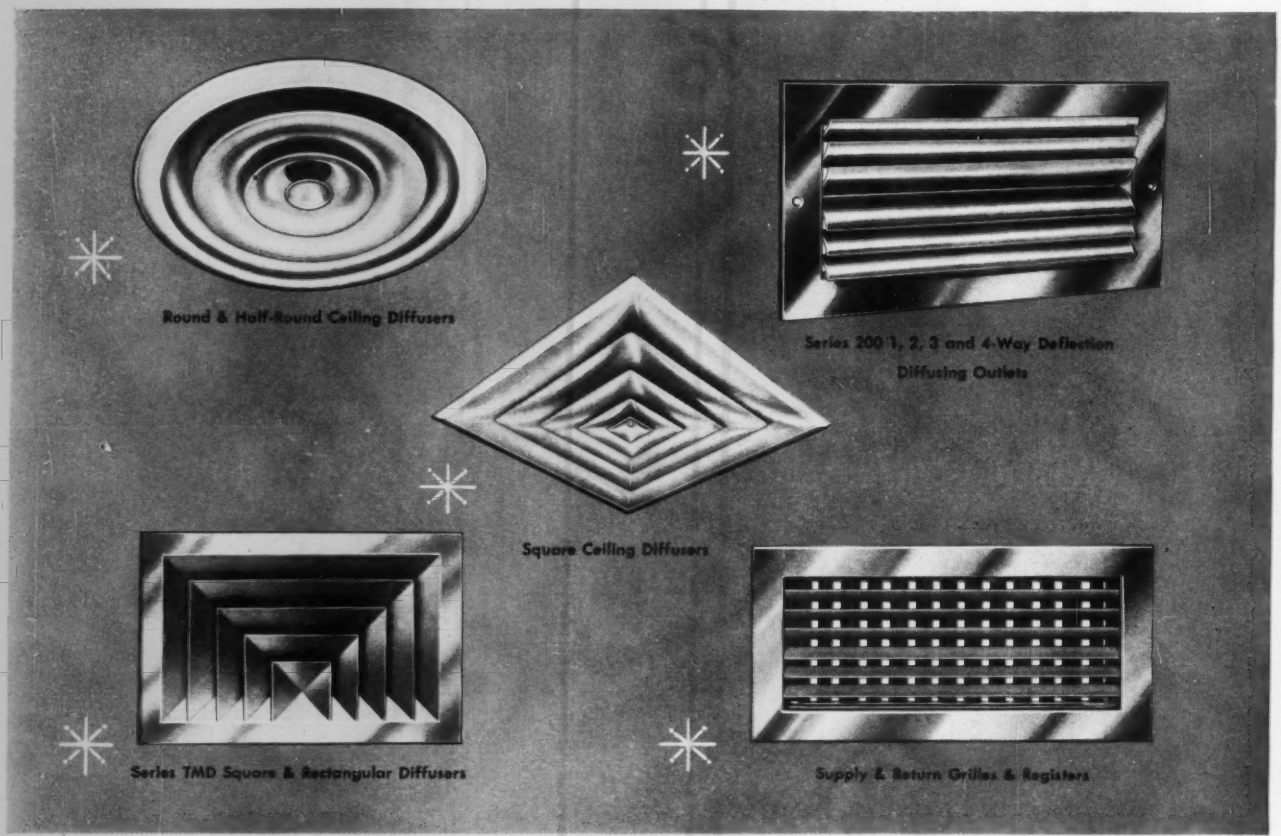
product

for outstanding design in the CONVENTIONAL . . .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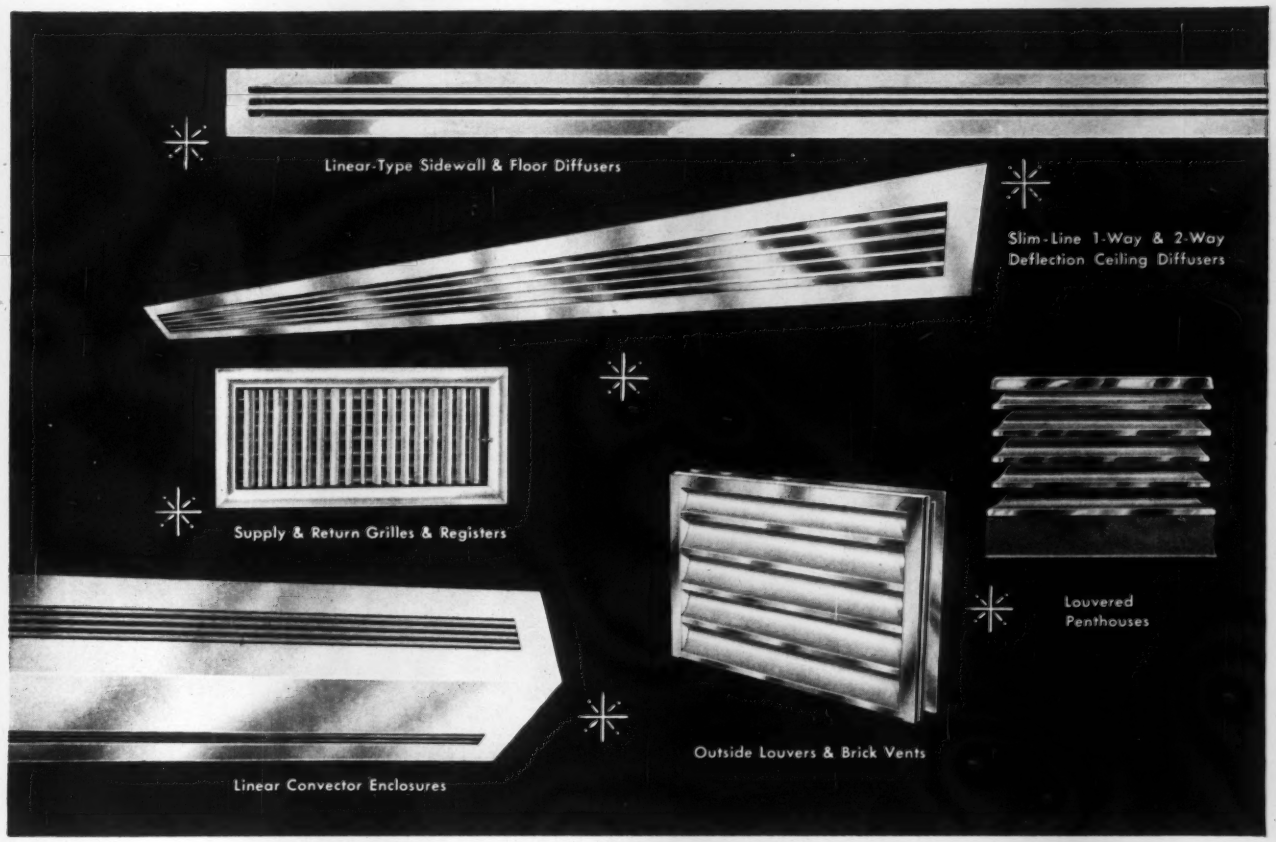
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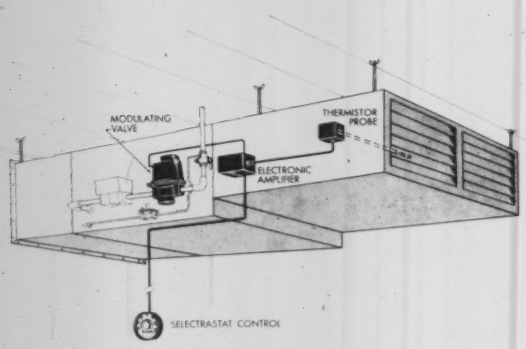
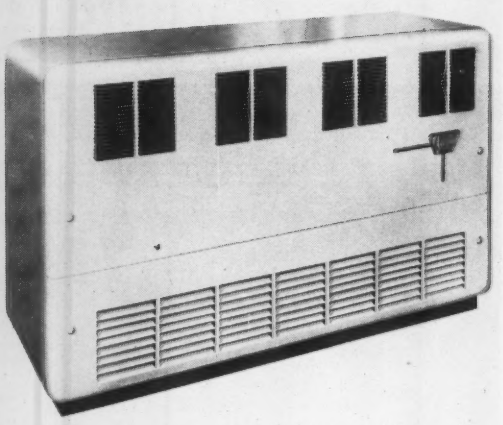


Duct Heater Control . . .

. . .electronic, for use with gas fired duct heaters in make-up air systems accomplishes variable input burner effect to meet varying outdoor-indoor temperatures, increasing flexibility of heater; probe inserted between heat exchanger and discharge outlet senses 1/10 degree temperature variations, signal is amplified to energize solenoid coil in modulating valve, causing pressure changes which alter gas burner input; modulation is variable from full to 1/3 fire, capacity rating 310,000 Btu per hr; literature available upon request — *Maxitrol Co.*, 12200 *Beech Rd., Detroit* 39, *Mich.*



Electric Cabinet Heaters . . .

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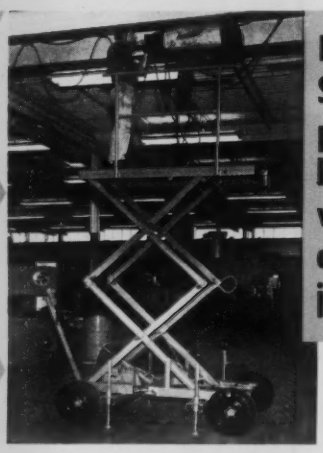

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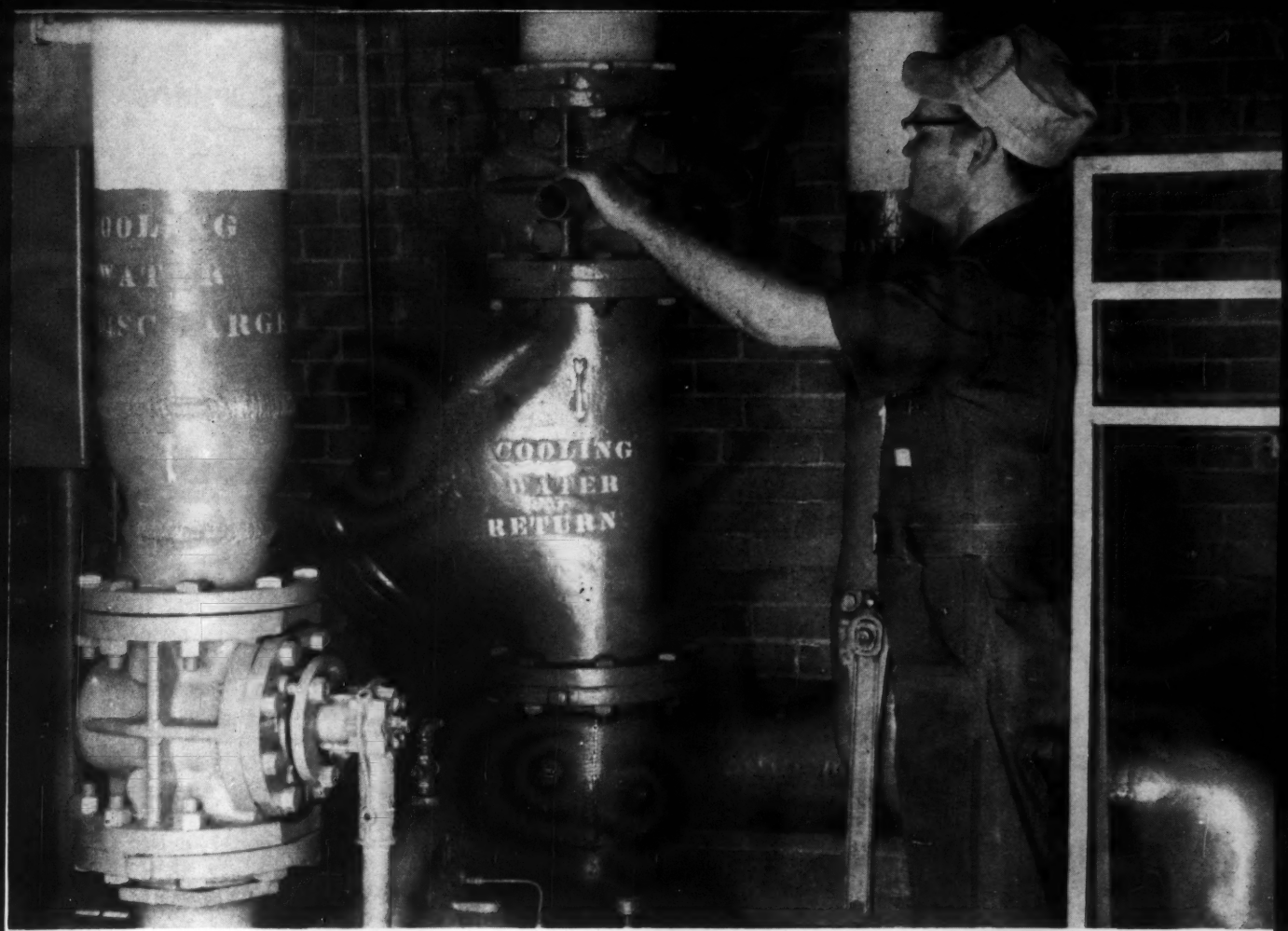

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SIZES TO 36": Lines above 8" are no longer a problem. Specify sizes and pressure rating to meet your design needs.

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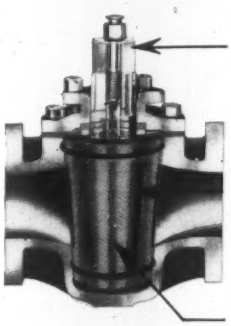

PERFECT BALANCE: Plug is smoothly, easily positioned for precise throttling . . . wrench shows degree of throttle.

THROTTLE or SHUT-OFF: If desired, shut-off valve can be eliminated downstream from throttle valve. Positive shut-off assured by pressurized lubricant.

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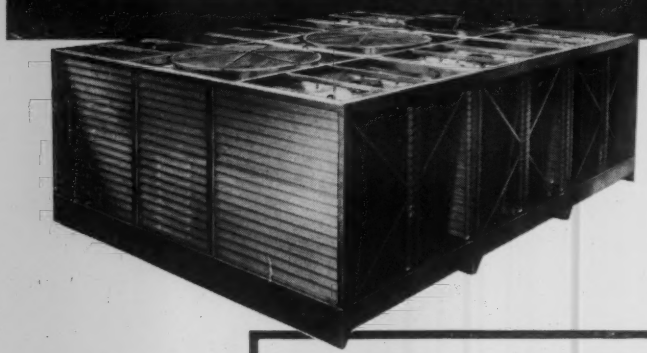

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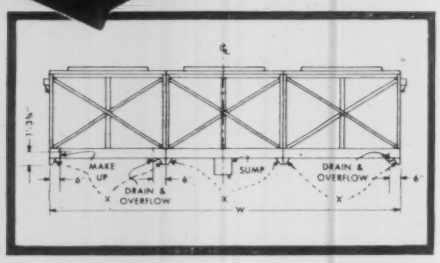

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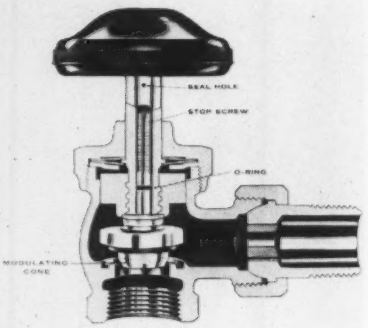
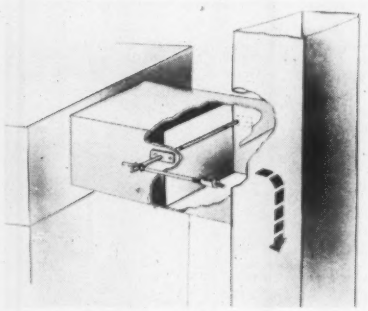


Orifice Valve . . .

. . . easily adjustable for balancing of steam and hot water systems; valve stem stop screw provides range of orifice adjustments from 10 to 100 sq ft EDR steam or variable hot water flow to element without shut-down or breaking of union connection; positive shut off can be accomplished without disturbing orifice setting; available in ½, ¾, and 1 in. sizes, angle, straight, or corner patterns — *Marsh Instrument Co., Div. of Colorado Oil and Gas Corp., 3501 Howard St., Skokie, Ill.*



Control Damper . . .

. . . for excess air volume compensation in central station systems where automatic closing of a supply duct overloads remaining ducts and creates drafts; unit is installed in connecting duct between supply and return plenum, consists of counterweighted damper adjusted to closed position when all supply ducts are open; automatic zone damper operation dumps air into return duct for recirculation — *Econo Products Co., Div. of Viking Instruments, Inc., East Haddam, Conn.*

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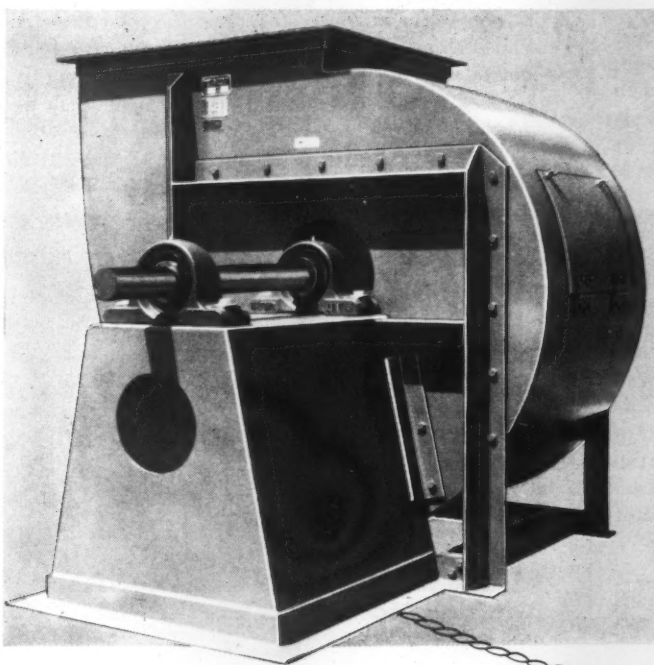

Shown here is our No. 330 BBC SWSI arrangement 1 Fan, with ratings certified by AMCA . . . just one of a whole family of efficiently-engineered Barry fans, giving dependable daily performance all over America.

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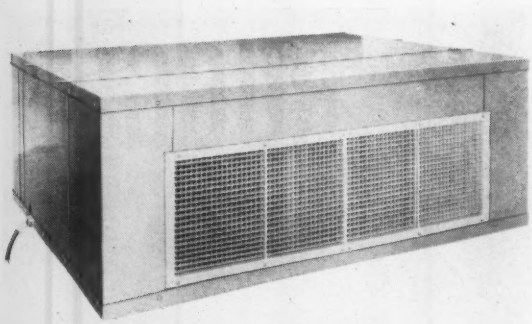

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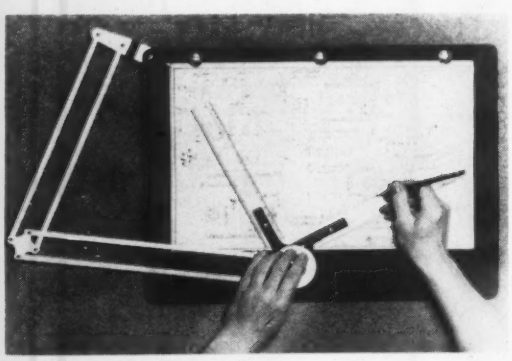

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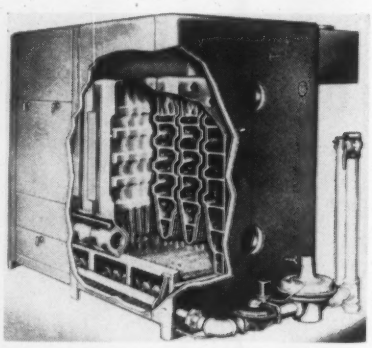

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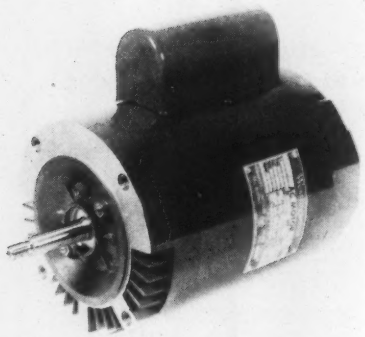

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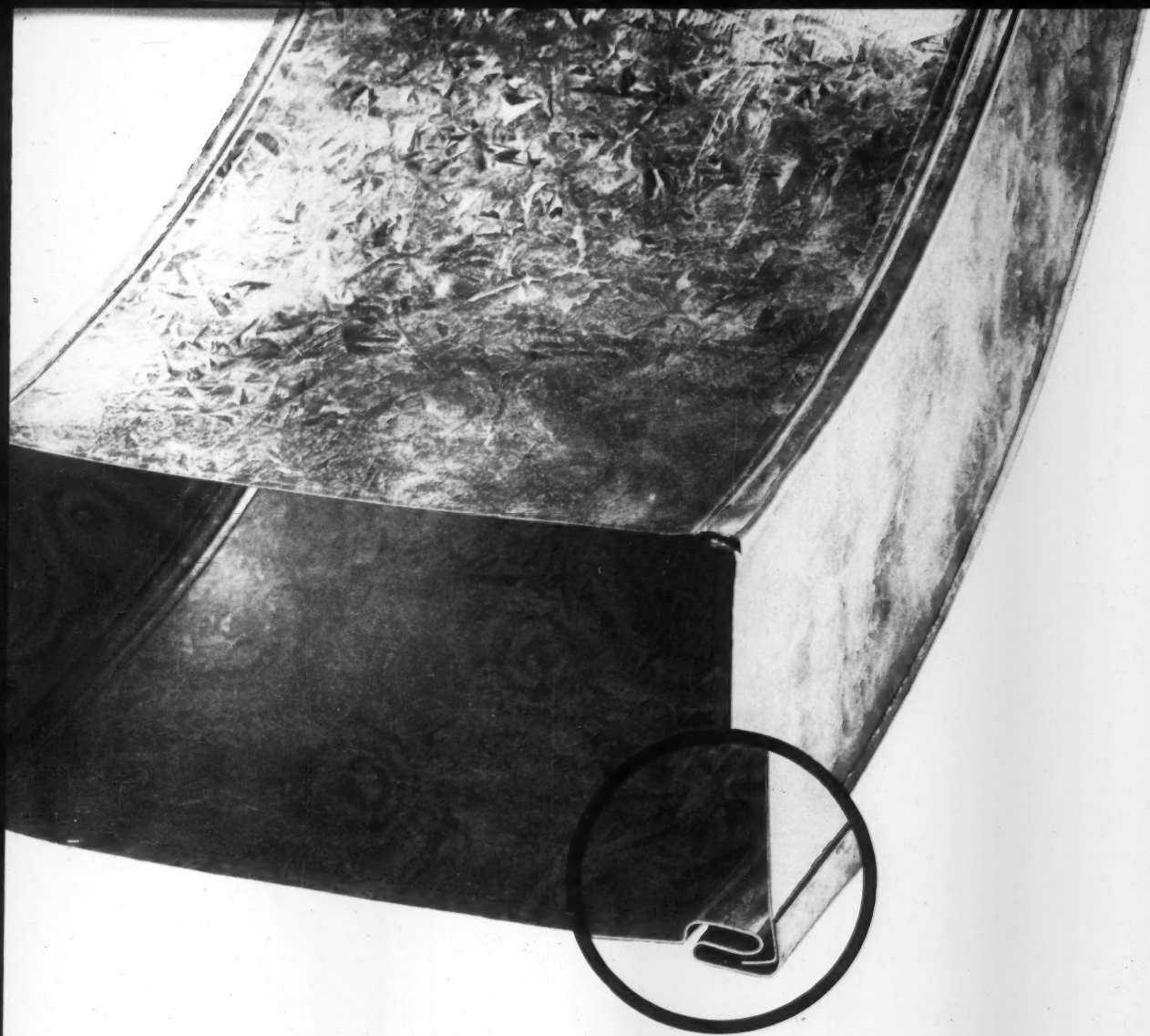

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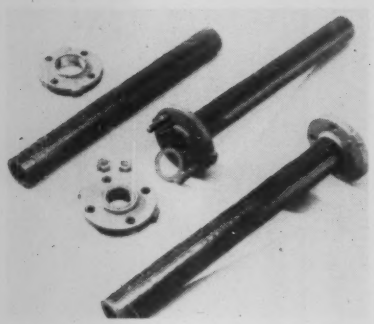

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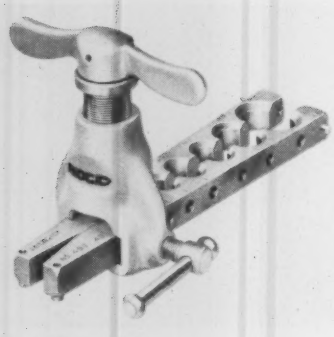

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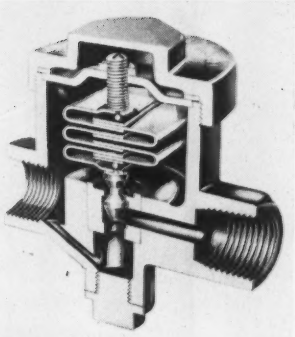
. . . in three models for copper, aluminum, and brass tubing, produce 45 or 37 degree flares; feature locked-together working parts for loss-prevention, automatic alignment and length gaging; eccentrically mounted steel flaring cone forms flares by rolling action, flare is burnished when feed screw is reversed — *The Ridge Tool Co., Elyria, O.*



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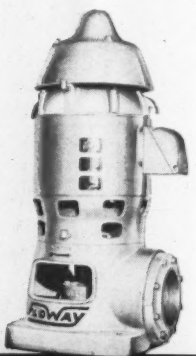

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FUEL COSTS DROP 40% with DRAVO COUNTERFLO HEATERS!

The problem . . . after plant expansion, 48,600 square feet of widely varying construction had to be heated efficiently. Some roofs were uninsulated, and large truck doors let in frigid air during winter. The old coal-fired steam heating plant was inadequate; a new heating system was needed. Management compared costs of various heating methods, including probable maintenance expense, and arrived at the following conclusion:

The solution . . . Dravo forced air space heaters. Floor mounted, thermostat controlled Dravo *Counterflo* heaters met requirements for comfort heating. Truck entries were protected by discharge nozzles aimed to provide a protective blanket of warm air. Each area was maintained at the desired temperature level. Drafts were eliminated, and heat loss to roof areas held to a minimum. Heating costs were lowered by 40%, a saving of *$.06 per square foot.*

Bonus benefits . . . include very low maintenance costs. A combination fireman-watchman was no longer needed—additional savings. The elimination of the boiler plant added 600 square feet of usable floor space. Use of Dravo Heaters permitted the installation of an automatic fire and burglar protection system, reducing insurance costs. Total savings to this company as a direct result of the installation of Dravo Heaters—$5,800 a year.

More information . . . on how Dravo *Counterflo* Heaters can help you lower heating costs. Send the coupon for details on the case history outlined above and full information on economical, high efficiency Dravo Space Heaters.

DRAVO
CORPORATION

Department H-13, Room M-214
Pittsburgh 25, Pa.

Send free bulletins on warm air space heating and the facts on the company mentioned above.

Name _____

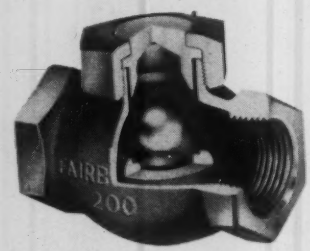
Company _____

Address _____

City _____ Zone ____ State ____

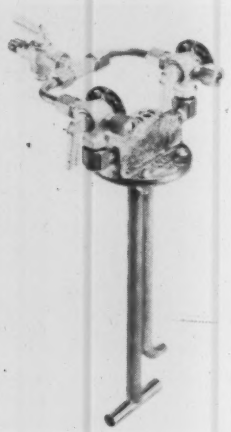
EQUIPMENT DEVELOPMENTS

Continued



Ball Check Valve . . .

. . . bronze, in sizes ¼ through 1 in., pressure ratings of 200 psi steam at 550 F, 400 psi cold water, oil, or gas; valve ball is stainless steel, lift space is designed to provide full port opening; for installation in upright position on horizontal lines only — *The Fairbanks Co., 393 Lafayette St., New York 3, N.Y.*

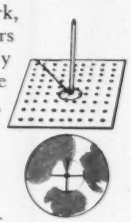


Pitot Tube . . .

. . . features blow out system which uses compressed air to clear probe and pressure element of obstructions, allowing measurement of gas or air velocity and pressure in dry dust or dirt laden environments; 3-way valve prevents blow out pressure from reaching gage or manometer; unit is stainless steel and brass, for use in temperatures up to 800 F; available in five sizes with nominal insertion lengths of 3, 6, 12, 18, and 24 in., suitable in each case for ducts twice that diameter — *F. W. Dwyer Mfg. Co., Dept. HA-8, P.O. Box 373, Michigan City, Ind.*

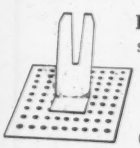
SAVE TIME— SAVE MONEY
with these dependable
INSULATION HANGERS

GEMCO
Spindle Hangers and W-A Self-Locking Washers



Ideal for insulation work, Gemco Spindle Hangers are easily and quickly installed . . . with positive adhesion to concrete, brick or metal. W-A Self-Locking Washers pressed over spindles with minimum effort and lock insulation securely in place.

GEMCO Pronged Hangers



Designed especially for supporting various types of block insulation. Easily applied for positive adhesion. Prongs (available in various lengths from 1 3/16" to 6 7/8") bend over to hold insulation firmly in place.

TUFF-WELD Nylon Hangers

Two-piece hangers . . . with bases of tough, mold nylon and spindles of metal. Made especially for smooth surfaces. Spindles snapped into bases as needed; reduces inventory, storage space, freight costs. W-A Self-locking washers hold insulation securely in place.

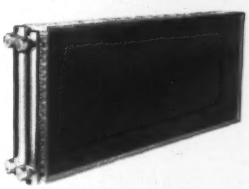
TUFF-BOND Quik-Set Adhesive (for smooth or slightly irregular surfaces) and Improved General Purpose Adhesive (for rougher surfaces) assure permanent adhesion of hangers when used as directed. Write or wire for details and specifications.

GOODLOE E. MOORE
INCORPORATED
DANVILLE 28, ILLINOIS

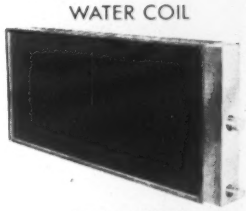
YONKERS RACEWAY CHOOSES BOHN

BOHN WATER AND STEAM COILS INSTALLED IN NEW CLUBHOUSE ADDITION

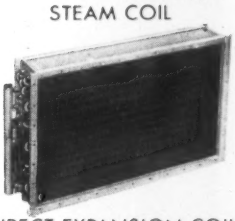
Mechanical Engineers: Guy B. Panero Engineers, New York—Nicholas Arteca in Charge
Architect: Lionel K. Levy, New York
Structural Engineer: Dr. Jacob Feld, New York
Contractor: James H. Martin, Inc., New York



WATER COIL



STEAM COIL



DIRECT EXPANSION COIL

Rugged, dependable Bohn coils were specified for *two complete air conditioning systems* installed in the modern new Clubhouse Addition at Yonkers Raceway, Yonkers, New York.

Three Bohn 6-row chilled-water coils of the double circuit copper-fin type with a total face area of approximately 70 sq. ft. provide a 40,000 C.F.M. system with a cooling capacity of 2,572,000 BTU/HR, while four Bohn 1-row steam distributing coils with a face area of nearly 42 sq. ft. have a heating capacity of 1,296,000 BTU/HR.

In the second system of 46,000 C. F. M., there are six Bohn 6-row chilled-water coils of the full circuit type with a face area of almost 81 sq. ft. and four Bohn 1-row steam distributing coils with a face area of 48 sq. ft. The cooling capacity is 2,330,000 BTU/HR and the heating capacity is 1,490,000 BTU/HR.

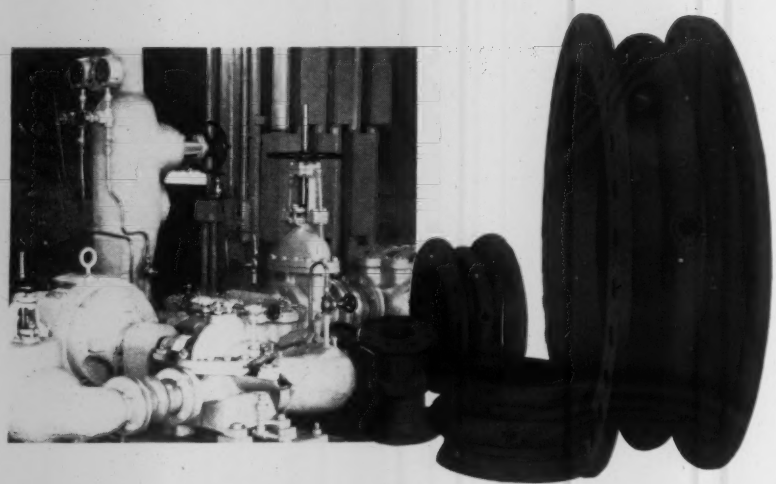
BOHN *KNOWN-CAPACITY* COILS feature . . .

- Die-formed plate-type aluminum or copper fins . . . from 4 to 14 per inch . . . with self-spacing collars completely covering the tubes. Permanent, tight, metal-to-metal fin-tube bond.
- Heavy-gauge casings die-formed from galvanized steel.
- Headers of heavy-wall seamless copper tube with heavy die-formed end caps. High pressure tested at 320 psig. minimum air pressure under warm water.
- Tested and rated according to ASHRAE standard 33-58.

For further information and specifications on BOHN Water, Steam, or Direct Expansion Coils, write today to . . .

BOHN *Buy the known line . . . the BOHN line*
ALUMINUM & BRASS CORPORATION
Danville Division • Danville, Illinois

Save... ON INSTALLATION AND REPLACEMENT COSTS *With* GOODALL *Rubber* EXPANSION JOINTS



Goodall Rubber Expansion Joints are flexible, durable connections for pipe lines and other equipment handling virtually all fluids and gases under pressure and vacuum, to prevent excess stresses due to expansion and contraction; to counteract vibration; and to insulate against undesirable sound. They can also be designed to overcome misalignment.

EASIER TO INSTALL—on new equipment or as replacements. Light in weight, with short face-to-face dimensions. Metal retaining rings quickly aligned and bolted. No gaskets required.

LONGER SERVICE LIFE—no embrittlement or corrosion. High resistance to abrasive wear.

STYLES, SIZES AND PRESSURES TO MEET ALL REQUIREMENTS

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"If it's GOODALL, it MUST be Good!"

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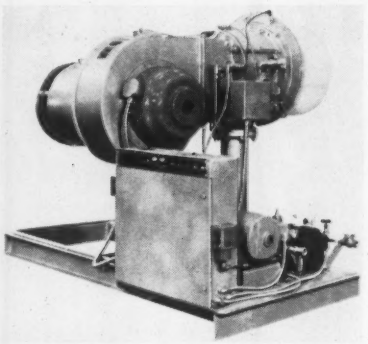
GOODALL *Rubber Company*

GENERAL OFFICES, MILLS and EXPORT DIVISION, TRENTON, N. J.

BRANCHES AND DISTRIBUTORS THROUGHOUT THE UNITED STATES. IN CANADA: GOODALL RUBBER CO. OF CANADA LTD., TORONTO.

EQUIPMENT DEVELOPMENTS

Continued



Burners . . .

. . . designed to operate with gas, light or heavy oil, or for dual-fuel firing, with input capacity ranges of 1 to 25 million Btu per hr; line features centrifugal fan combustion air supply, hinged burner units for ease of access; may be used with negative and positive pressure boilers of wide variety design — *The North American Mfg. Co., 4455 E. 71st St., Cleveland 5, O.*

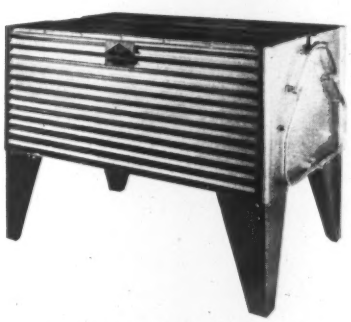
Pressure Indicator . . .

. . . incorporates measuring system with d-c power supply in single integral unit; zero and span adjustment can be made from instrument's power chassis, plug-in type measuring system is compensated for ambient temperature conditions; uses linear scale with 4.9 to 5.5 millivolt span; can be used with plug-in control chassis for pressure control applications; in two models using different transducers; bulletin "F-9951" available upon request — *Wheelco Instruments Div., Barber-Colman Co., 1701 Rock St., Rockford, Ill.*

durability stands out in

Marley Series B DriCooler

AIR COOLED CONDENSERS



Ask the Marley Man (or write) for Bulletin DC-60 that explains why DriCoolers also have outstanding . . .

capability
adaptability
compatability
controlability

Rugged, rigid construction is the basic premise of Series B DriCooler design, in which Marley engineers considered only the full-day, full-year type of service demanded of condensers in supermarket and similar heavy-duty commercial installations.

Coils, fans and drive elements all were selected after exhaustive testing for ability to "stand up and take it." They are housed in a frame engineered of heavy angles and sheets hot dip galvanized after fabrication. These components are welded and bolted to form a super-sturdy, unitized structure in which casing panels have no supporting function.

The result: a shake-proof, quake-proof, leak-proof condenser that is free from vibration and rattle . . . one that will quietly deliver full performance year after year after year.

U. S and Foreign Patents Pending

THE MARLEY COMPANY MARLEY **KANSAS CITY 14, MISSOURI**

Remington Stud Driver

The basic Power Unit...

Here's the single basic tool that gives you a new degree of on-the-job fastening versatility. Only *one* basic unit to buy — the Remington Model 455A — for all your fastening applications. Just choose the instantly interchangeable fastening attachment you need to do the job!

Plus choice of 4 fastening attachments...

K-1 1/4" & 3/8" Light Duty Captive Stud Attachment uses 22 cal. Power Loads. Use where extra safety is needed.

K-2 1/4" Light-Duty Attachment uses 22 cal. Power Loads. Handles 80% of your fastening jobs.

K-3 3/8" Medium-Duty Attachment drives heavy-duty studs with inexpensive 22 cal. Power Loads.

K-4 3/8" Medium and Heavy-Duty Attachment. Uses both 22 and 32 cal. Power Loads. For toughest jobs.

offers greatest single-tool fastening versatility!

The Remington Stud Driver offers these exclusive features:

- Four fastening attachments for light, medium, heavy-duty work, including the special Captive Stud Attachment for extra-safe fastening. No other single tool can cover such a variety of applications.
- Medium-duty fastening—requiring ⅜" studs—can be done with low-cost 22 caliber Power Loads.
- Positive one or two-hand operation at operator's option . . . no buttons or release to hold while fastening.
- Greater variety of applications made possible with instantly interchangeable guards. These 4" square, hollow "safety guards" fit snugly over work, trap spall and dust. More than 40 types are available.

Send coupon for free booklet about the Remington Stud Driver—your best buy in powder-actuated fastening tools!

Remington

DUPONT

Remington Arms Company, Inc., Bridgeport 2, Conn.
IN CANADA: Remington Arms of Canada Limited, 36 Queen Elizabeth Blvd., Toronto 18, Ont.

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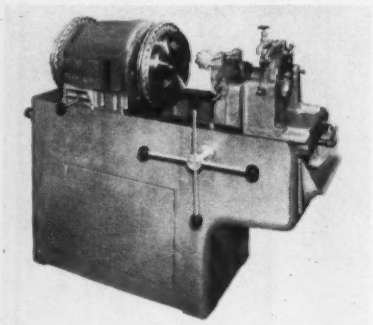
Please send—without obligation—information on Remington Contractor & Industrial Equipment checked below:

☐ Stud Drivers ☐ Air Tools ☐ Chain Saws
☐ Concrete Vibrators ☐ Flexible Shaft Machines

*Name*_____ *Position*_____
*Company*_____
*Address*_____
*City*_____ *Zone*____ *State*____

EQUIPMENT DEVELOPMENTS

Continued

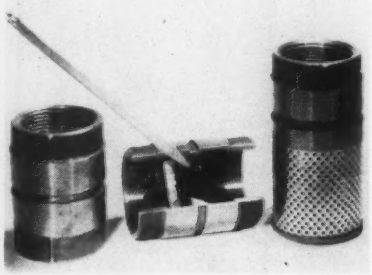


Threading Machine . . .

. . . for 1 in. through 4 in. pipe uses only two dieheads and two sets of dies for economy; lightweight, may be trailer mounted; roller or knife type cutoff is optional, machine can be used for grooving for couplers, beveling for welding, or cutting plastic pipe — *Beaver Pipe Tools, Inc., 310 Dana Ave., Warren, O.*

Blueprint File . . .

. . . wall-type, with steel tube frame, handles blueprints, drawings, other large sheet materials for storage or frequent-use purposes; sheets hang flat, eilminating curl, rubber-tipped lock-clips are used to mount sheets in clamp hangers; available in two sizes for 30 and 42 in. maximum sheet widths — *Lewbill Industries, Inc., 8 Spring St., Scottdale, Pa.*



Check & Foot Valves . . .

. . . brass, feature new poppet design for two-stage seating; neoprene poppet contains two molded-in rings, smaller of which seals under low pressure and larger as pressure increases; available in ¾, 1, 1-¼, 1-½, and 2 in. pipe sizes — *Clayton Mark & Co., 1900 Dempster St., Evanston, Ill.*

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handling problems...
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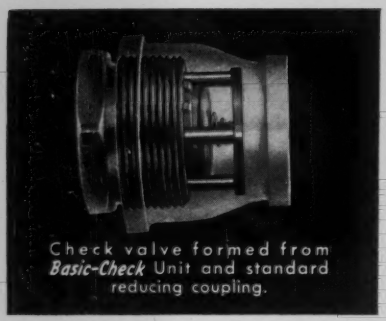
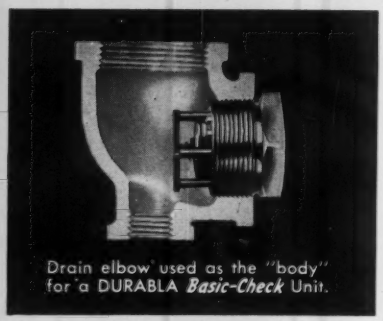
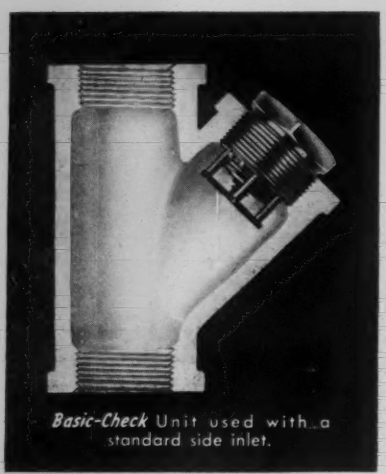


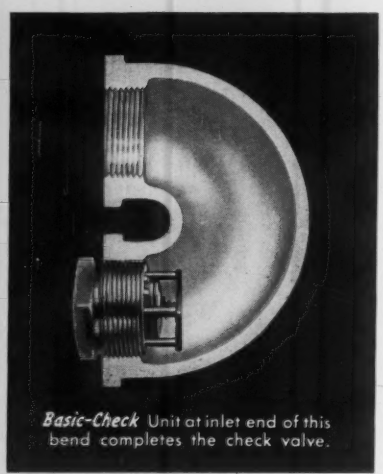
Check valve formed from *Basic-Check* Unit and standard reducing coupling.



Drain elbow used as the "body" for a DURABLA *Basic-Check* Unit.



Basic-Check Unit used with a standard side inlet.



Basic-Check Unit at inlet end of this bend completes the check valve.

How you can "make" a check valve to meet any emergency

Just take a DURABLA *Basic-Check* Unit*... combine it with a standard pipe fitting... and you have a complete check valve that's perfect for practically any service. Keep a few *Basic-Check* Units on hand and you are prepared for any emergency.

Because it will operate in any position, the DURABLA *Basic-Check* Unit can be installed without changing existing lines. Made of stainless steel, they'll handle almost any liquid, gas or air... over a broad range of pressure-temperature ratings.

DURABLA *Basic-Check* Units are versatile, dependable, efficient and inexpensive. They come in seven standard line sizes, from ⅜" to 2". Also available: DURABLA Reducing Couplings of stainless steel.

Ask for a copy of Bulletin HP80.

DURABLA MANUFACTURING COMPANY
114 Liberty Street, New York 6, New York

DURABLA®

DM-32

*U. S. Patent No. 2,649,277; Canadian Patent No. 549,618

EQUIPMENT DEVELOPMENTS

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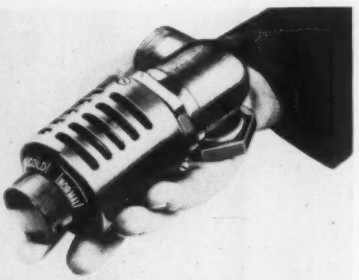
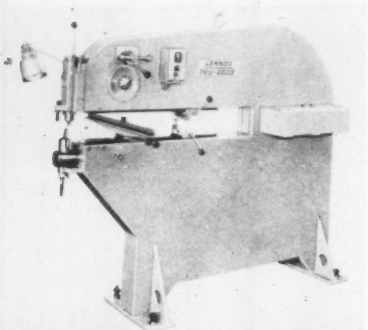


Radiator Control . . .

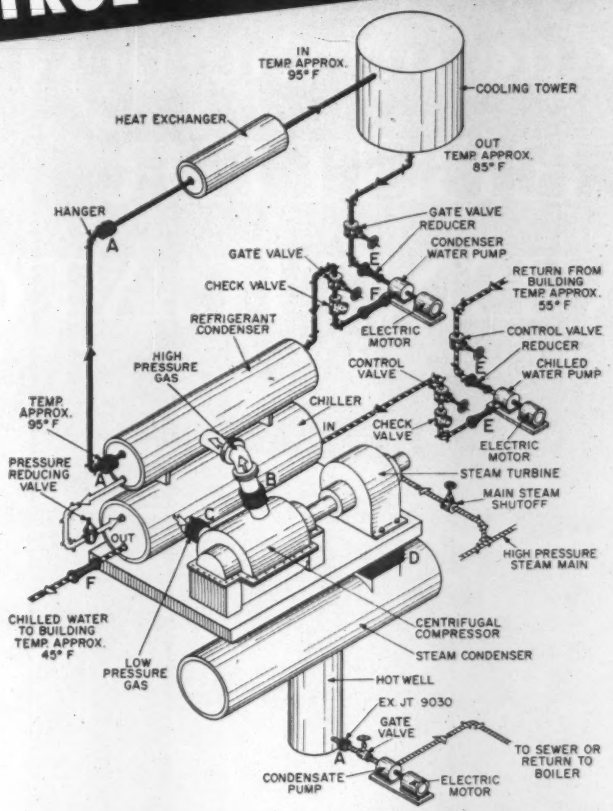
. . . for steam or hot water applications modulates supply to maintain constant temperature within 1-½ F for any setting between 60 and 80 F; dial may be locked to prevent tampering; unit is self-contained, requires no connection to any external device or power supply, permits individual radiator adjustment to balance system; literature available upon request — *Sterling, Inc.*, 5201 *W. Clinton Ave., Milwaukee* 23, *Wis.*



Metal Shear . . .

. . . cuts straight, circular, inside or irregular shapes, slots and louvers performs beading, planishing, flanging, edge bending, joggling, nibbling and hole piercing operations; with edge-cutting capacity of 1 gage mild steel or 5 gage stainless, 49-¼ in. throat depth; operates with reciprocating upper and stationary lower tool, tool strokes variable from 0.035 through 0.250, strokes per minute being automatically regulated; maximum cutting speed is 36 fpm; features single-unit, stress relieved weldment construction; bulletin "250" available upon request — *Lennox Tool and Machine Builders, Dept.* 173, *Lima, O.*

HOW TO CONTROL VIBRATION & EXPANSION



a steam-driven, centrifugal-compressor AIR CONDITIONING SYSTEM

La Favorite protection for these stress points:

A Expansion Joint 9060, standard duck and rubber, for use in pressure system, absorbs axial pipeline motion.

B Expansion Joint 9030, neoprene lined. For pressure, absorbs axial and transverse motion. Neoprene acceptable for refrigerant No's 12, 13, 114, 22.

C Expansion Joint 9015 with control unit, for vacuum service. Neoprene lined for refrigerant No.'s 12, 13, 114, 22.

D Expansion Joint 5030 or 4030, for pressure service. Absorbs oscillation. Internal or external flanges.

E vibrJoint LF15R, LF25R, absorbs vibration, eliminates purchase of metal increaser or reducer. Neoprene and duck.

F vibrJoint LF15 and LF25. Neoprene and duck, eliminates water hammer.

One of a series

How Expansion and Vibration Joints Extend System Life, Reduce Maintenance

Modern air conditioning equipment, when properly installed, is designed to give long, maintenance-free service. To take full advantage of this equipment, your refrigerant and coolant pipeline systems should also be designed for long, efficient service. To do this, some basic problems common to most large systems must be solved. They are: (1) protection of the system from severe expansion and contraction, (2) absorption of pump and compressor noise, (3) protection of pipelines from misalignment and fracture caused by settling, and (4) protection of the system from electrolytic corrosion.

These problems can be solved through planned use of expansion and vibration joints. La Favorite designs and manufactures a full range of expansion and vibration joints for use in temperatures of —40°F to 250°F, and for handling brines and such refrigerants as numbers 12, 13, 114, and 22.

La Favorite expansion and vibration joints are a sound investment, whether incorporated into your system during the design stage, or used to modernize existing systems. More complete information on La Favorite products and engineering services is available on request. Write for Bulletin 982.

LA FAVORITE RUBBER MFG. CO.

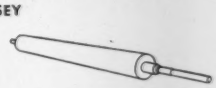
256 WAGARAW ROAD, HAWTHORNE, NEW JERSEY

FIELDLINK®

FABRICATED PVC

PROCESSING EQUIPMENT

MOULDED GOODS


RUBBER COVERED ROLLS

PNEUMATIC GASKETS

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WEBSTER UNIT VENTILATOR

for Complete Comfort Control with WEBSTER SYSTEM FOR SCHOOLS

A WEBSTER UNIT VENTILATES AS IT HEATS OR COOLS FOR COMPLETE CLASSROOM COMFORT

Simply heating today's classroom is not enough. Adequate ventilation and cooling are equally vital in providing a comfortable environment in which to teach and learn. The new Webster Unit Ventilator meets all three requirements in a single unit designed especially for school installation. It *ventilates* as it heats or cools—assures gentle circulation of filtered air at the right temperature throughout the room. Room air and outdoor air are blended by a damper of exclusive design which assures proper ventilation and draft-free comfort. Each unit is completely self-contained. No expensive central system duct work is required. The Webster Unit Ventilator is engineered to be used with Webster "Tru-Perimeter" Walvector to provide a blanket of heat the length of every wall. Functionally styled storage units integrate Walvector and Unit Ventilator into a custom installation to complement every school interior. A fully illustrated brochure details performance and installation advantages possible only with the new Webster Unit Ventilator. Write for a copy today, or ask your Warren Webster man about the complete line of Webster System Products for Schools.

• • •

Webster "Tru-Perimeter" Walvector • Webster Cabinet Heaters and Propeller-Fan Unit Heaters • Webster Convector Radiators • Webster System Traps and Valves • Webster Unit Ventilator

WARREN WEBSTER & COMPANY, INC.
HEATING • COOLING / CAMDEN 5, NEW JERSEY

. . . BUY ALL 3 FROM 1

Wolverine produces all three in a wide range of sizes and alloys, in straight lengths and coils, and in both finned and plain tube forms.

When you're in the market for copper, brass or aluminum tube you can save time by making Wolverine your "buy" word. You obtain the product you need—made the way you want it—packaged to your exact requirements—and delivered when you want it.

Anticipating customer demands, and having the equipment, know-how and skilled employees needed to meet those demands, are all part of Wolverine's Tubemanship program. Wolverine customers can avail themselves of a wide range of specialized services in addition to various types of tubing.

Wolverine, for example, maintains complete fabrication facilities—is able to fin, spin, bend, coil—in short to do just about anything tubing customers require. From Wolverine's constant research program has come tubing specially designed to help solve the problems of such complex industries as refining, petro-chemical and petroleum processing, refrigeration and air conditioning—to name but a few.

▲ ▲ ▲

For your convenience Wolverine maintains sales offices in 33 American cities. Complete information can be found in Wolverine's General Products Catalog. Write for your copy—TODAY.

J-8894

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Calumet & Hecla, Inc.
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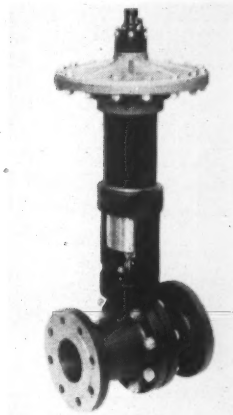
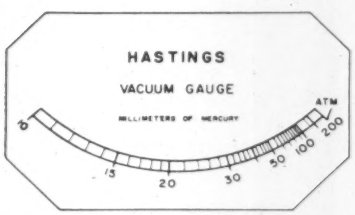
Manufacturers of Quality-Controlled Tubing
PLANTS IN DETROIT, MICHIGAN, AND DECATUR, ALABAMA. SALES OFFICES IN PRINCIPAL CITIES

EQUIPMENT DEVELOPMENTS
Continued



Control Valves . . .

. . . sliding gate, in 4 and 6 in. sizes, with built-in valve positioners manufacturer recommends for large pressure drop systems, high viscosity fluids, high pressure applications, or for amplification of control signal; positioners operate on force-balance principle — controller air plus valve spring force are balanced against positioner air pressure plus positioner spring force — to accurately match valve opening to control signal; positioner device available as original equipment or in conversion kits; bulletins "J-170" and "SRBc 24-60" available upon request — *OPW-Jordan Corp.*, 6013 *Wiehe Rd.*, *Cincinnati* 13, *O.*



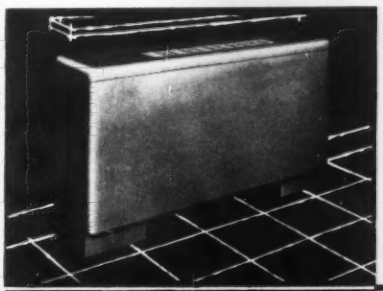
Vacuum Gage . . .

. . . electric, for 10 to 200 mm Hg absolute range, available in cabinet, panel, control, and recorder type instruments; operates on 90 to 135 v a-c, offers direct reading pressure measurements unaffected by atmospheric pressure changes or exposure; supplied with matched interchangeable gage tubes, and available in multi-position models for monitoring up to five positions — *Hastings-Raydist, Inc., Hampton, Va.*

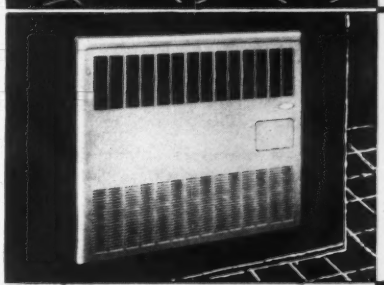
LOOK TO . . .

Airtherm

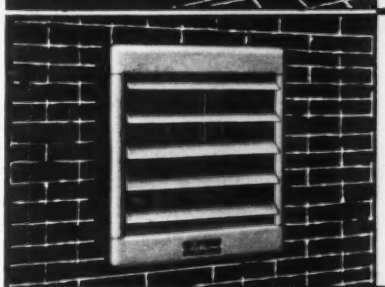
for quality, engineered heating, ventilating and air conditioning products



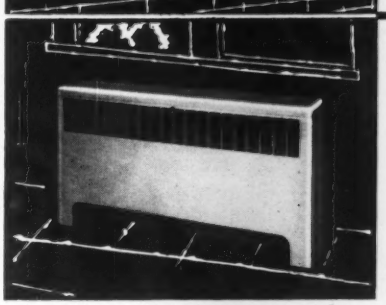
AIR CONDITIONING UNITS— perfect application for new construction or remodeling of offices, motels, apartments, schools, hospitals. Healthful all season conditioned air with recirculating and fresh air mixtures. Remote type for use with a central source of hot and chilled water.



CABINET UNIT HEATERS— with predominantly popular, more efficient direct drive. Entire unit constructed of 16 gauge steel. Sizes from 375 to 1630 CFM. Complete variety of types and mounting arrangements. Steam and hot water.



PROPELLER FAN UNIT HEATERS— 52 models of steam and hot water horizontal and vertical unit heaters. Capacity ranges from 22,750 to 555,000 BTU. Water coils available for high temperature drop requirements.



CONVECTORS — lowest cost installed wet heat. Versatile units combine attractive appearance with efficient operation.

Dependable supplier of quality heating, ventilating and air conditioning equipment for more than 30 years. For trouble-free, efficient performance, always specify AIRTHERM.

Write For Catalogs

Airtherm **MANUFACTURING COMPANY**
702 South Spring Avenue, P. O. Box 7039
Saint Louis 77, Missouri

EVERY ENGINEER will want these FACTS!

NEW EDITION
Bulletin No. 31-A

Other Types of Thermal Expansion Piping Problems Economically Solved by Barco Ball Joints
Space-Saving Expansion Loops Made With Ball Joint Fittings
How to Solve Piping Flexibility Problems
BARCO BALL JOINTS
THERMAL EXPANSION AND CONTRACTION

"HOW TO SOLVE

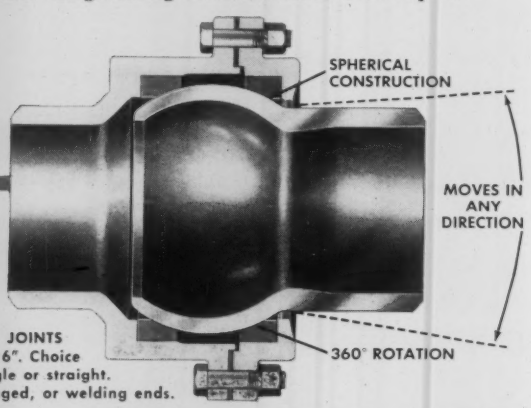
PIPE EXPANSION

PROBLEMS"

TODAY there is an easier way to accommodate *thermal expansion* in piping! No need to install special devices—in virtually every instance, you can put *flexibility* right in the line itself with standard BARCO BALL JOINTS:

1. **SUPERIOR METHOD.** New Steam Power Stations . . . Oil Refineries . . . Chemical Plants . . . Paper Mills . . . Office Buildings . . . Schools now are using this money-saving method.
2. **LONG LIFE.** No rubber, no thin metal members subject to fatigue or "blow-out." No lubrication, no grease packing. Self-adjusting; pressure sealing.
3. **FIRE-SAFE.** The joints have passed rigid fire, high temperature, and water quench tests.
4. **SAVE SPACE, CUT COSTS.** No pressure thrust — expensive anchoring or bracing not required to hold piping in place or in line. Cuts space required for pipe loops and U-bends.
5. **VERSATILE.** Easy to handle compound twisting movements, wide variations in temperature and pressure—steam, air, oil, water, gas and chemicals.

SEE your Barco Representative for information or write. Ask for the new revised Bulletin No. 31-A, "How to Solve Piping Flexibility Problems." *Engineering recommendations on request.*



BARCO BALL JOINTS
Sizes ½" to 16". Choice of styles, angle or straight. Screwed, flanged, or welding ends.

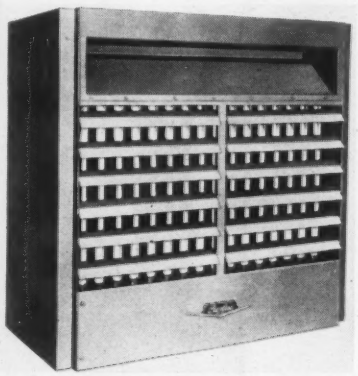
PRODUCTS BACKED BY EXPERIENCE
BARCO
FOUNDED 1908

BARCO MANUFACTURING CO.
541J Hough Street • Barrington, Illinois

The Only Truly Complete Line of Flexible Ball, Swivel, Swing and Revolving Joints
In Canada: The Holden Co., Ltd., Montreal

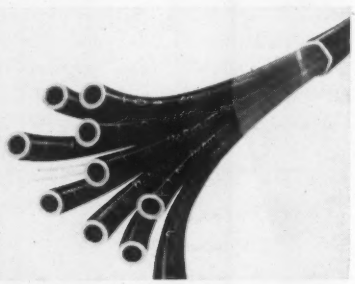
EQUIPMENT DEVELOPMENTS

Continued



Unit Heaters . . .

. . .direct gas fired, in size range from 175,000 to 300,000 Btu per hr, can be used with natural, LP, mixed and manufactured gases; complement propeller fan and blower models offered previously, both types now available in 25,000 through 300,000 Btu models; all models are available with either aluminized or stainless steel heat exchangers, and with cast iron burners — *Peerless Mfg. Div., Dover Corp., P.O. Box* 2015, *Louisville, Ky.*



Tubing Harness . . .

. . .for instrument tubing applications, with black polyethylene core tubes for high ultraviolet resistance, plasticized tape core wrapping, and extruded vinyl sheath; construction prevents penetration by vinyl plasticizers, keeps tubing bundle flexible and is light weight; tubes are number coded for ease of installation, available in various tube combinations of 2 through 37 core tubes of ¼ or ⅜ in. OD, in lengths up to 1000 ft and over — *Dekoron Products Div., Samuel Moore & Co., Mantua, O.*

Let it sleet, let it ice, let it blow— there are "summer sidewalks" in winter's snow

In Madison, Wisconsin, with its average winter temperature of 21°F. and snowfall of 39 inches, it takes a lot of manpower to keep sidewalks safe and clean in winter. At the new State Office Building in Madison, public interest required the efficient and prompt removal of snow and ice from the building's 12-foot sidewalk.

The solution was simple—install a *steel pipe* snow melting system. Now, whatever the weather outside, the sidewalks are summer safe, free of ice and snow. And inside, lobby floors and corridors need no hour-to-hour cleanup of tracked-in dirt.

Snow melting and ice removal are only two of the many jobs which *steel pipe* can do better and more easily. *Steel pipe* has "built-in" strength and dimensional stability; it's economical, easily bent and weldable. Because *steel pipe* offers more for less it is the most widely used tubular product in the world for heating and cooling, for refrigeration and ice making, for water, air and gas lines, for vent and drainage lines, and for fire sprinkler and electrical conduit systems.

C. A. Hooper Company, Construction Contractors

Easily formed and joined steel pipe, imbedded in concrete, circulates hot liquid that keeps the sidewalk summer-safe and clear of ice and snow.

For complete information—write for your copy of the 32-page booklet "Steel Pipe Snow Melting and Ice Removal Systems".

COMMITTEE ON STEEL PIPE RESEARCH

150 East Forty-Second Street, New York 17, N. Y.

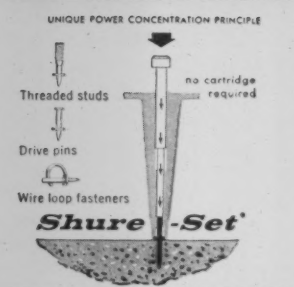
STEEL PIPE IS FIRST CHOICE

- Low cost with durability
- Strength unexcelled for safety
- Formable—bends readily
- Weldable—easily, strongly
- Threads smoothly, cleanly
- Sound joints, welded or coupled
- Grades, finishes for all purposes
- Available everywhere from stock

Insist on MADE IN USA Steel Pipe

C-3

FOR MORE ECONOMICAL FASTENING TO CONCRETE



Newly-patented hammer actually absorbs shock, increases power and reduces worker fatigue. Ask for model R-400.

other products by

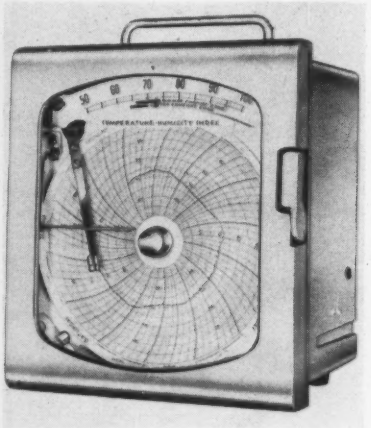
When a job calls for light-duty fastening into concrete or block, Shure-Set is the ideal choice! This hammer-powered tool (no cartridge required) is designed to pinpoint hammer strokes on the head of special austempered fasteners, setting them permanently in hard materials up to 15 times faster than out-moded methods.

There's a Shure-Set fastener to meet every need of the plumbing and heating contractor who wants to save time and money while getting the most dependable fastenings on pipe hangers, duct straps, tie-downs, control boxes, thermostatic systems and a host of day-to-day applications. Write today for details, or call your Shure-Set dealer (under "Tools" in the Yellow Pages).

Ramset® Fastening System

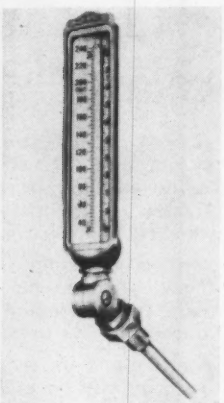
OLIN MATHIESON — WINCHESTER-WESTERN DIVISION
291-H Winchester Ave. • New Haven 4, Conn.

EQUIPMENT DEVELOPMENTS
Continued



Temp-THI Recorder . . .

. . . designed for use in determining air conditioning requirements and for checking present installation operation; in two models, to record both temperature-humidity index and ambient temperature, or temperature-humidity index only; recorder is self-contained and portable, with spring driven chart; bulletin "H1010" available upon request — *The Bristol Co., Waterbury 20, Conn.*



Industrial Thermometer . .

. . . with adjustable angle feature utilizes stem which rotates to any position for reading without parallax error, is positive locking without special tools; available with standard separable socket, extension neck socket for insulated lines, adjustable stem for air duct installations, in 7, 9, and 12 in. scale sizes—*Moeller Instrument Co., Richmond Hill 18, N.Y.*

Bid Lower... PROFITABLY

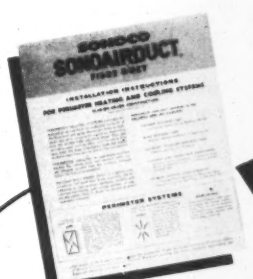
Food Center, Taylor University, Upland, Indiana.
Oris Eash, Fort Wayne, Indiana, Architect

Because SONOAIRDUCT Fibre Duct is low in cost and saves so much installation time and labor, it helps you *bid lower* on slab perimeter heating, cooling, or combination systems.

Lightweight, easy-handling SONOAIRDUCT joins and levels quickly . . . can be cut to exact lengths with a hand saw. There are no sharp edges to contend with, and it won't chip, crack, or break when dropped . . . every piece of SONOAIRDUCT is usable!

You're assured of consistently high quality when you use Sonoco SONOAIRDUCT—America's best-selling Fibre Duct. It has been subjected to F.H.A. testing procedures, and meets or exceeds all F.H.A. criteria and test requirements for products in this category.

Protect yourself, your reputation, and the interests of your customers by installing the best—Sonoco SONOAIRDUCT Fibre Duct!



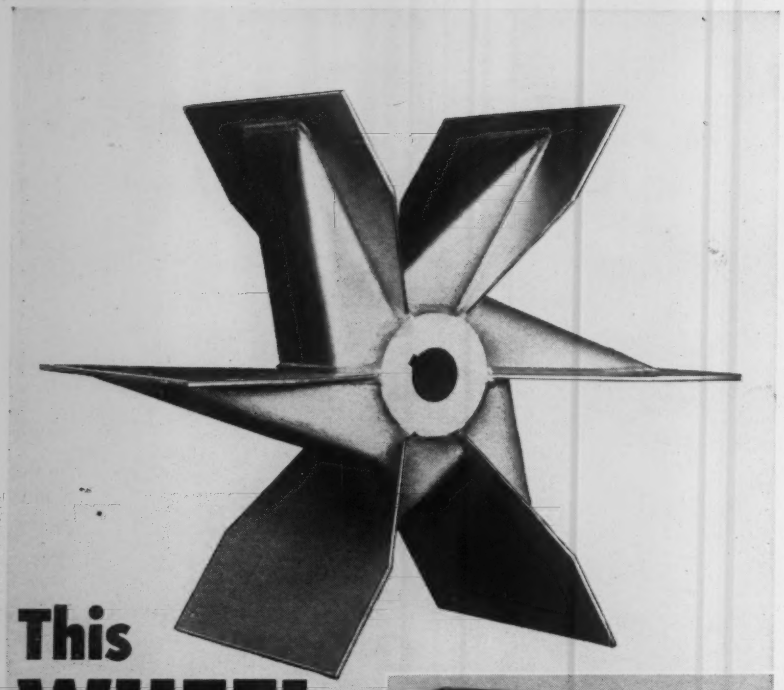
FREE INSTALLATION MANUAL
Contains latest, detailed, step-by-step installation data for SONOAIRDUCT Fibre Duct. For free copy, send us your name and address on company letterhead.

5104

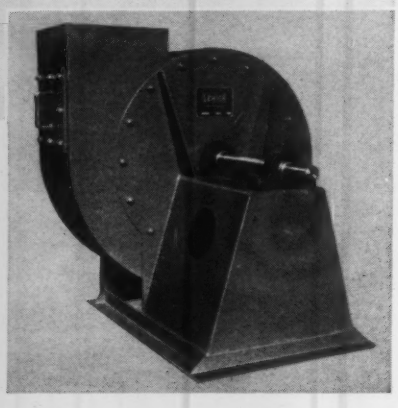
See our catalog in Sweet's, or write for complete information and prices to:

SONOCO
Construction Products

SONOCO PRODUCTS COMPANY, HARTSVILLE, S. C. • La Puente, Calif. • Fremont, Calif. • Montclair, N. J. • Akron, Indiana
Longview, Texas • Atlanta, Ga. • Brantford, Ont. • Mexico, D. F.



This WHEEL



MAKES LEHIGH I. E. INDUSTRIAL FANS IDEAL FOR TOUGH INDUSTRIAL EXHAUST APPLICATIONS

Handles dust-laden air and gases, paper shavings and the like without clogging

Lehigh Industrial I.E. Fans . . . featuring heavy duty, unique channel construction, all-welded mild steel wheels of the long shaving design . . . solve difficult exhaust problems because of their non-clogging characteristics. They incorporate a universal housing, which permits rotation and discharge to be modified to facilitate variable field conditions.

A complete range of sizes is available in both 70° to 250°F and 251° to 600°F construction. All standard drive arrangements are available and will be furnished according to your specifications.

Rugged, air-tight construction: the fan housing is welded on the inside with a continuous fillet weld. This provides gas-and air-tight housing with joints of maximum strength.

Standard, self-aligning ball-bearing pillow blocks . . . grease lubricated . . . are featured on all Lehigh Industrial I.E. Fans.

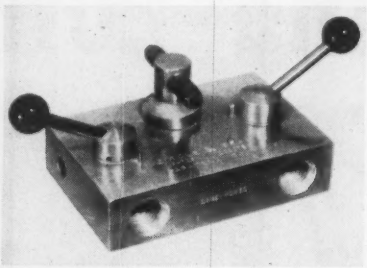
Optional accessories include an inspection door, inlet and outlet flange, heavy duty housing construction, and drain plug.

Get detailed information on how Lehigh I.E. Industrial Fans can solve your industrial exhaust problems with dependable non-clogging performance. Your Lehigh Representative will be happy to supply you with full details. Or, if you choose, write directly to us for Bulletin L-5: 2172 LF-2

LEHIGH FAN & BLOWER DIVISION
FULLER COMPANY, CATASAUQUA 1, Pa.
Subsidiary of General American Transportation Corporation

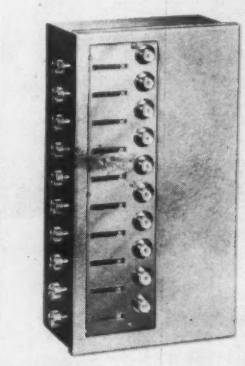
TRADE LEHIGH MARK

EQUIPMENT DEVELOPMENTS
Continued



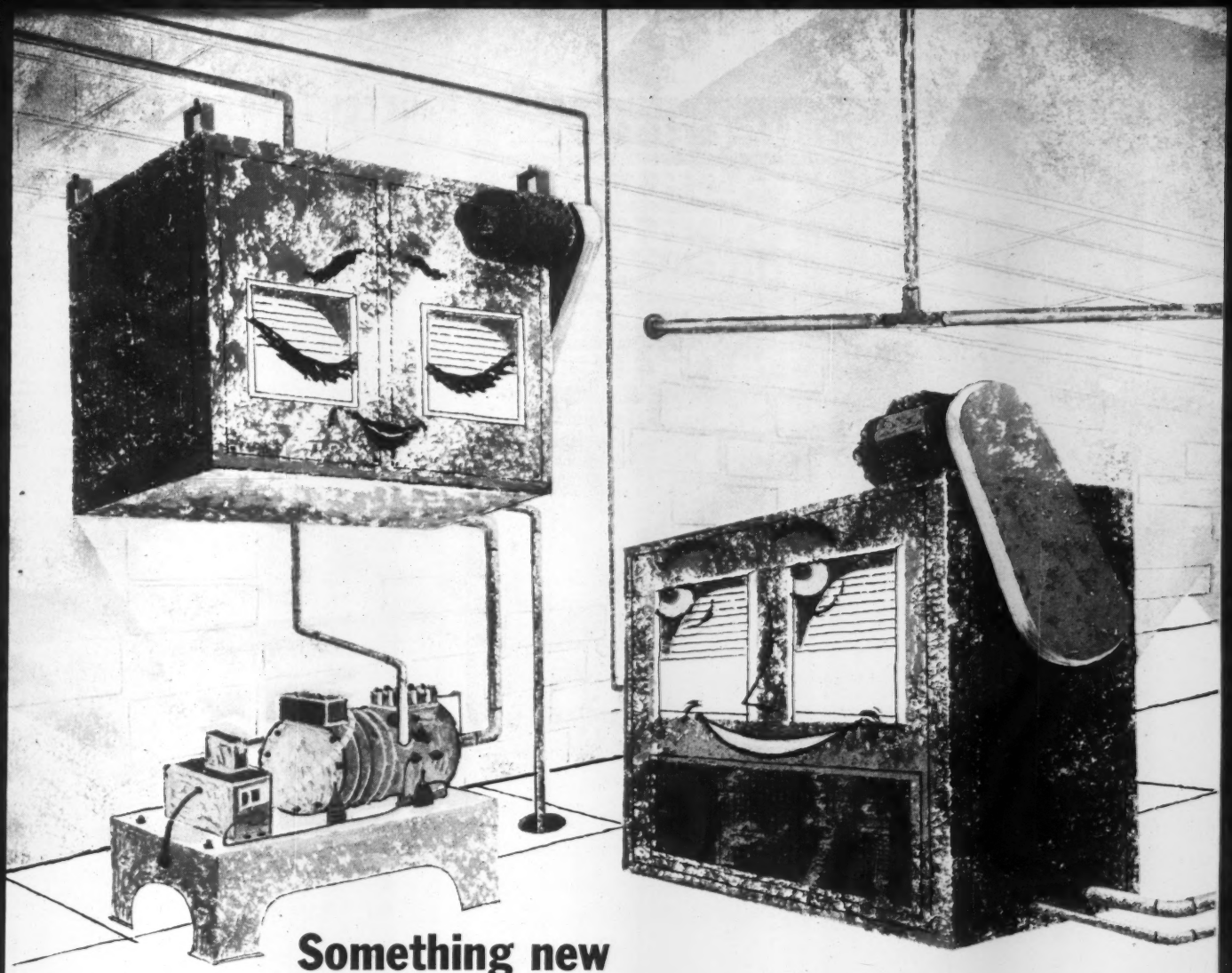
Manifold Valve . . .

. . . combines three valves in one unit to eliminate cross-port leakage in differential type measuring, recording, and transmitting instruments; of brass and stainless steel, for operating pressures from 0 up to 2000 psi with wide variety of fluids; toggle-type handles indicate valve position, balancing valve handle is color-coded — *Circle Seal Products Co., Inc.*, 2181 *E. Foothill Blvd., Pasadena, Calif.*



Time Recorders . . .

. . . for cumulative running time recording of up to 10 machines simultaneously can be used for variety of checks including data accumulation for preventive maintenance and cost statistics; 10 meters in single 7 × 13 in. cabinet available for reading to nearest hour and tenth; hour, tenth, and hundredth; or minutes and tenths; may be connected to show running time, idle time, or service time; signal light shines when individual meter is recording; operates on 26 or 115 v a-c, monitors at distances up to 5000 ft — *Gorrell & Gorrell*, 336 *Old Hook Rd., Westwood, N.J.*



Something new for the air conditioning boys... and coils!

Now, Air Handlers from Halstead & Mitchell in 880 to 47,500 CFM Range

AH Series Air Handling Units

Halstead & Mitchell

Before you buy any Air Handler, check and compare these new H&M units, feature for feature and price for price.

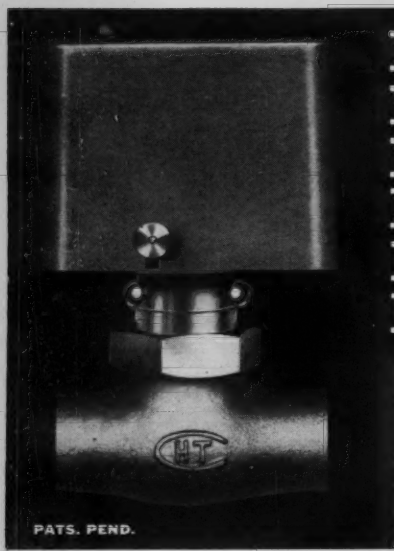
See how easily H&M Air Handlers accommodate matching cooling and heating coils, with space for up to 12 rows of coil depth overall! If you like, H&M coils (from 2 to 68 square feet of face area) can be factory-installed, leaving protruding connections on either side for easy hook-up. Halstead & Mitchell makes the coils you need to match: direct expansion, chilled water, hot water, standard or non-freeze steam. Filter sections are also available.

Performance? H&M Air Handlers deliver air against static loads up to 2-inches water gauge, and do it quietly.

Construction? They're the sturdiest units in the field. Forward curved centrifugal blowers are enclosed in a heavy gauge cabinet featuring formed steel corner posts and flush mounted panels.

Price? Just ask your H&M distributor. You'll be pleased. He has all the engineering information, too. Or, you can write for Bulletin AHU-100, Halstead & Mitchell, Bessemer Building, Pittsburgh, Pa.

Air Handlers • Finned Coils • Air-Cooled Condensers • Cooling Towers • Water-Cooled Condensers



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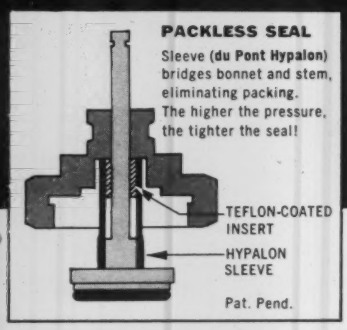

PACKLESS SEAL
Sleeve (du Pont Hypalon) bridges bonnet and stem, eliminating packing. The higher the pressure, the tighter the seal!
TEFLON-COATED INSERT
HYPALON SLEEVE
Pat. Pend.

ZONVALVE®

the zone control valve constructed to last!

Engineers and heating men know—it's *construction* that tells the story!

Zonvalve's packless design (Hypalon sleeve and Teflon-coated stem) means no friction—no wear—no adjustments. Zonvalve *can't* leak!

A heavy-duty motor powers Zonvalve. Pinion, spur gear and cam assembly relieves motor strain, guarantees long operating life.

Zonvalve's globe-type construction insures 100% shut-off, providing positive temperature controls with no heat waste through "seepage."

Those are the unique construction features behind Zonvalve's unconditional written five-year guarantee.

Zonvalve is easy to install, and operates with equal efficiency mounted in any position. It is made in all standard pipe and tubing sizes, straight and angle, from ½" to 1¼". Hand-size compactness permits installation in space as small as a baseboard enclosure. And, of course, wiring is low-voltage.

For positive temperature control on steam and hot water systems, for modernization or new construction—specify Zonvalve, install Zonvalve.

Write for informative Brochure P-8.

ZONVALVE

Zonvalve's Trade-Mark is your guarantee of positive zone control. Accept no substitute!

HEAT-TIMER CORP. 657 BROADWAY, NEW YORK 12, N. Y.
MFRS. OF HEATING CONTROLS SINCE 1937

IN CANADA: HEAT-TIMER CO. · 767 WARDEN AVE., SCARBOROUGH · TORONTO, ONT.

RECENT TRADE LITERATURE . . .

▸ *AIR COMPRESSORS*—reciprocating carbon-ring type, for hospital and laboratory central systems requiring oil-free, low temperature air, described in booklet "NM-285.000", with drawings and dimension tables for horizontal receiver mounted, base plate mounted units and vertical receivers; duplexing of compressors is discussed, with description of drive and control equipment and optional accessories. *National Cylinder Gas Div., Chemetron Corp., 840 N. Michigan Ave., Chicago 11, Ill.*

▸ *AIR SAMPLER*—"Bantam" model discussed in new leaflet which specifies recommended filter paper for use in sampling dusts and aerosols; portable unit is diagrammed, with dimensional and capacity data, prices, accessories. *Gelman Instrument Co., 106 N. Main St., Chelsea, Mich.*

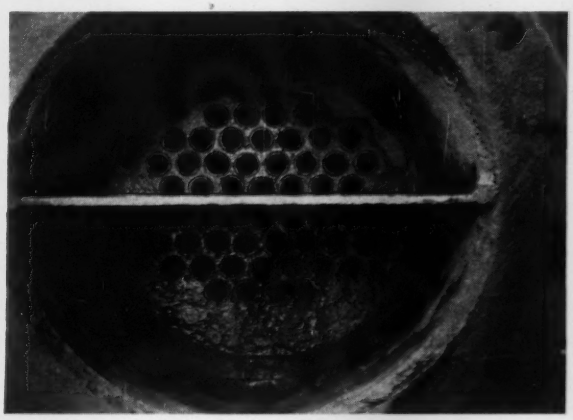
▸ *AIR SAMPLER*—portable, for indoor and outdoor sampling, employs turbine type blower principle, for detection of particles as small as one hundreth micron in diameter; manufacturer states unit was originally developed by New York office of AEC; brochure explains various civilian uses for which it is now available. *The Staplex Co., Air Sampler Div., 777 Fifth Ave., Brooklyn, N. Y.*

▸ *ALUMINUM*—illustrated "buyers' guide" presents quick facts on coil, sheet, plate, tubing, pipe, rod, and bar available from stock, with specifications, mechanical properties, tolerances, machinability ranges, finishes, corrosion resistance and relative costs of alloys also detailed. Bulletin "30-1". *Joseph T. Ryerson & Son, Inc., Box 8000-A, Chicago 80, Ill.*

▸ *ARC WELDING EQUIPMENT*—line of automatic and semiautomatic units is detailed in new brochure which illustrates applications for different automatic welding processes. *Hobart Brothers Co., Troy, O.*

Descale cooling towers, evaporative condensers, ice-making machines rapidly, effectively with **dry acid** cleaners based on **Du Pont Sulfamic Acid**

SAFER, EASIER TO USE. Dry acid cleaners eliminate hazards of handling liquids, particularly where carboys are involved. These cleaners can be added directly to sump of cooling tower or evaporative condenser . . . dissolve scale fast—destroy algae, too!



LESS CORROSIVE. For descaling condenser tubes (above) and other parts, sulfamic cleaners are less corrosive than liquid cleaners . . . on brass, 60% less; on steel, 70%; copper, 85%; aluminum, 95%. Many sulfamic cleaners can be used safely on galvanized steel.

LOWER HANDLING COSTS. This 100-lb. drum of dry acid cleaner is more than equivalent to this carboy of inhibited muriatic acid weighing 192 lbs. You'll save on shipping, handling and storage expenses. And no deposits because drums are disposable.

NON-FUMING. These dry acid cleaners produce no corrosive gases, either dry or in solution. No harmful fumes to cause corrosion in vapor spaces of equipment or damage to electrical and operating parts . . . and never a toxic fume problem to personnel.

Ask your supplier for safer, effective cleaners based on Du Pont Sulfamic Acid or mail coupon for additional information and names of formulators who offer these compounds.

E. I. du Pont de Nemours & Co. (Inc.)
Industrial and Biochemicals Department, N-2539-HP
Wilmington 98, Delaware.

Please send me ☐ sulfamic acid general equipment cleaning bulletin, ☐ names of formulators offering cleaners based on sulfamic acid.

*Name*_____

*Company*_____

*Address*_____

*City*_____ *Zone*_____ *State*_____

DU PONT
REG. U.S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING . . . *THROUGH CHEMISTRY*

RECENT TRADE LITERATURE

Continued

▸ *ARC WELDING EQUIPMENT*—form "ADC 717F" covers line of manual and automatic units including manual gun for applications employing carbon dioxide, plus machine heads for production welding and new accessory equipment. *Air Reduction Sales Co. Div., Air Reduction Co., Inc.*, 150 *E. 42nd St., New York* 17, *N. Y.*

▸ *ARC WELDING GUIDE*—gives information on five essentials for proper welding procedures, shows examples of good and bad welds, discusses personnel, material, equipment, methods, training, safety, and nomenclature. *Hobart Brothers Co., Troy, O.*

▸ *ARC WELDING TECHNIQUES*—for small diameter piping discussed in bulletin "2112.3" which lists advantages of welded piping installations, describes procedures, types of electrodes, explains welding cost calculation. *The Lincoln Electric Co.*, 22801 *St. Clair Ave., Cleveland* 17, *O.*

▸ *BOILERS*—for high temperature hot water systems covered in folder which describes design criteria, gives dimensions, capacities, and construction details, discusses control systems, auxiliary equipment, gives specifications for controls, boilers, other information on high temperature hot water systems. *Boiler Engineering & Supply Co., Inc., Manovan St., Phoenixville, Pa.*

▸ *BRAZING TECHNIQUES*—for all commercial brazeable metals and alloys described and illustrated in manual which discusses basic brazing functions, presents solutions to common brazing problems, with sections on copper and its alloys, aluminum, cast iron, steel, and stainless steel. *All-State Welding Alloys Co., Inc.*, 249-55 *Ferris Ave., White Plains, N. Y.*

▸ *CENTRIFUGAL FANS*—booklet gives information on manufacturer, capacity tables, dimensions for twin and triple blower assemblies, cabinet blowers, 4-way discharge blowers, with photographs of models, suggested specifications, ordering information. *Airfan Engineering Co.*, 7401 *Telegraph Rd., Los Angeles* 22, *Calif.*

▸ *CENTRIFUGAL FANS*—bulletin "A-1103" describes new series in 15 sizes, single and double-inlet construction; with cutaway illustrations of wheel and blade construction for Class I, II, and III, discussion of modifications for adaptation to wide variety of applications; section on volume control, and capacity tables. *American-Standard Industrial Div., Detroit* 32, *Mich.*

▸ *CENTRIFUGAL FANS*—specification bulletin describes "K" series of one and two-blower packaged units designed to match manufacturer's gas-fired duct heaters; with performance data tables for selection of

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LUCKY LUCY?

No! No rabbit's foot for her. She knows many cancers can be cured if found in time — so she gets a health checkup every year. She also knows contributions can help conquer cancer—so she gives generously to the American Cancer Society. Send your gift to "Cancer," in care of your local post office.

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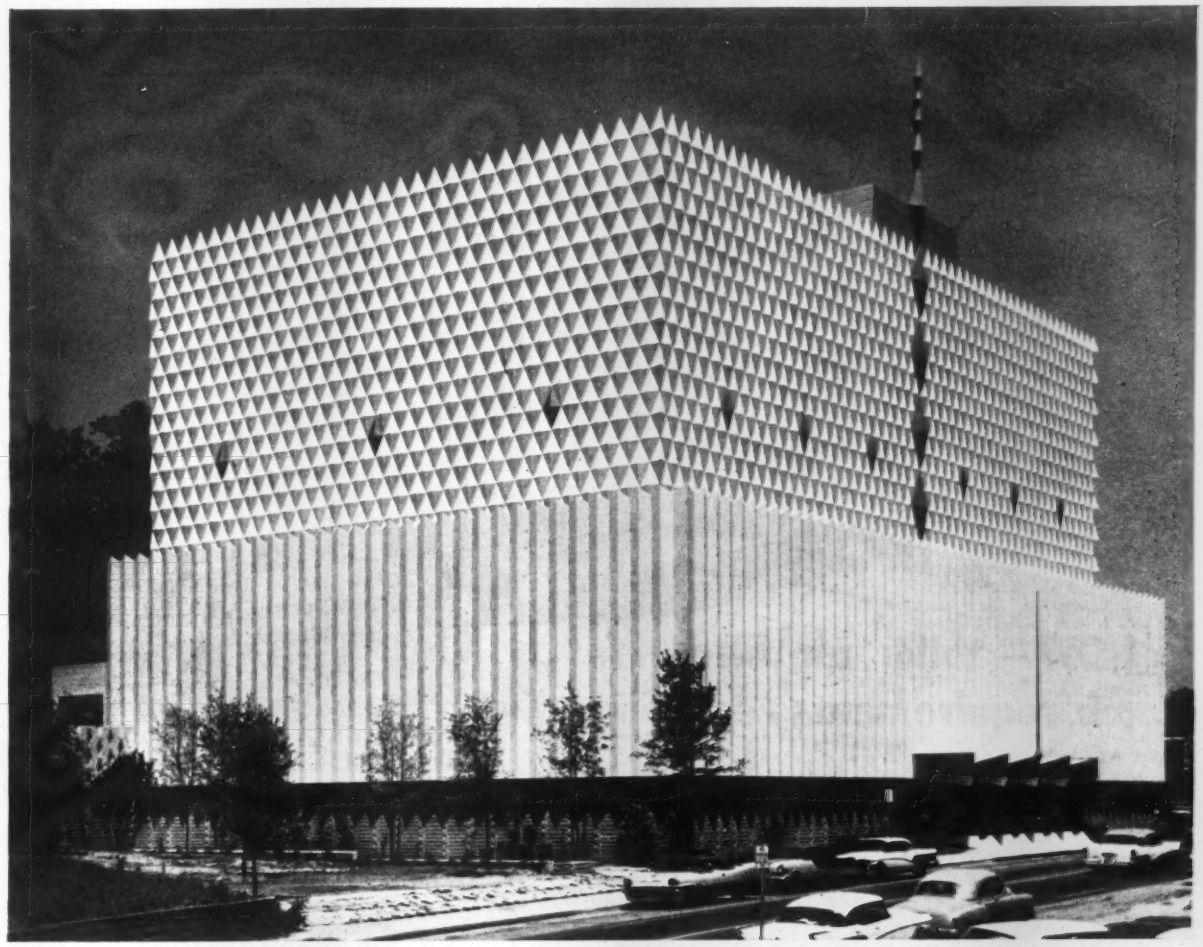
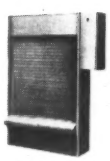


Abundant Life Building, Tulsa, Oklahoma. Architect: Cecil Stanfield; Contractor: Sigler, Inc.

In Tulsa's Abundant Life Building:

CLEAN AIR *by AAF*



Multi-Duty.

This gleaming marble structure was designed to serve both as an office building and a place of worship for the Oral Roberts Evangelistic Association. Though the building itself is unique, the Association relied on a time-tested success formula to keep interior air clean: they talked with the people at AAF.

Only AAF makes *all kinds* of air filters. From this complete line, they selected the one filter that would give them the *air-cleaning efficiency they needed plus the filter maintenance characteristics they wanted.* In this case, the automatic self-cleaning Multi-Duty filled the bill.

Take a look at what we mean by a *really complete* line of air filters. Call your local American Air Filter representative or write direct for Bulletin 518. Address: Mr. Robert Moore, American Air Filter Company, Inc., 373 Central Avenue, Louisville, Kentucky.

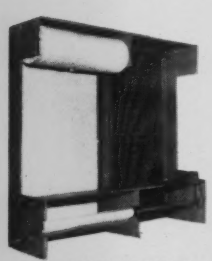
AAF **American Air Filter**

BETTER AIR IS OUR BUSINESS

Large industrial panel filter installation.

NOW — tailor air filters to job requirements - economically!

A *new concept* in air purification, MICROMAT offers not one but *nine* separate filter media, each with specific capabilities. Used singly or in combination, there is a low-cost MICROMAT medium to meet virtually *any* set of specifications for efficiency and air flow. Thus the MICROMAT System, with a *choice* of media, provides the means of tailoring air filtration to your exact requirements.


MICROMATIC Roll Filter Machine — automatic, semi-auto., or manual operation

Efficiency Range — 5% to 85%

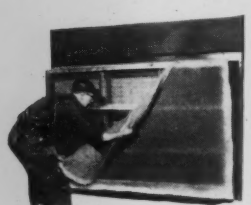
MICROMAT Replaceable Media are made from various types of non-woven synthetic fibers. Their natural filtering properties eliminate any need for viscous coating, yet MICROMAT media efficiencies range from 5% to 85% (using Discoloration Test procedures).

Cut Maintenance Costs

MICROMAT filters are easy to maintain . . . and normally afford worthwhile savings in handling, changing, and storage space when compared to permanent, washable filters and other replaceable types. Versatile in use, MICROMAT media are readily adaptable to panel (frame), blanket, or roll machine installation.

MICROMAT Outperforms Conventional Filters

Present users have found that, at any given air velocity, the right MICROMAT medium will outperform conventional filters and deliver cleaner air at lower overall cost.


BLANKET Filtration eliminates frames, increases capacity 12-15%.

For complete technical information on the MICROMAT System of Air Filtration, write for FREE brochure on your company letterhead.

(Where a washable, permanent filter is required, Microtron Corp. offers new MICROFOAM, a superior, acid and base resistant, plastic foam material with wide range of efficiencies and high dirt-loading characteristics.)

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Dept. R-23, P. O. Box 2092, Charlotte, N. C.

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RECENT TRADE LITERATURE
Continued

drives and motor sizes for 2000 to 6000 cfm and 4000 to 12,000 cfm models, transition duct dimensions for 150,000 to 1 million Btu per hr matching duct heaters. Bulletin "EN-6055." *Reznor Mfg. Co.*, 51 *Union St., Mercer* 8, *Pa.*

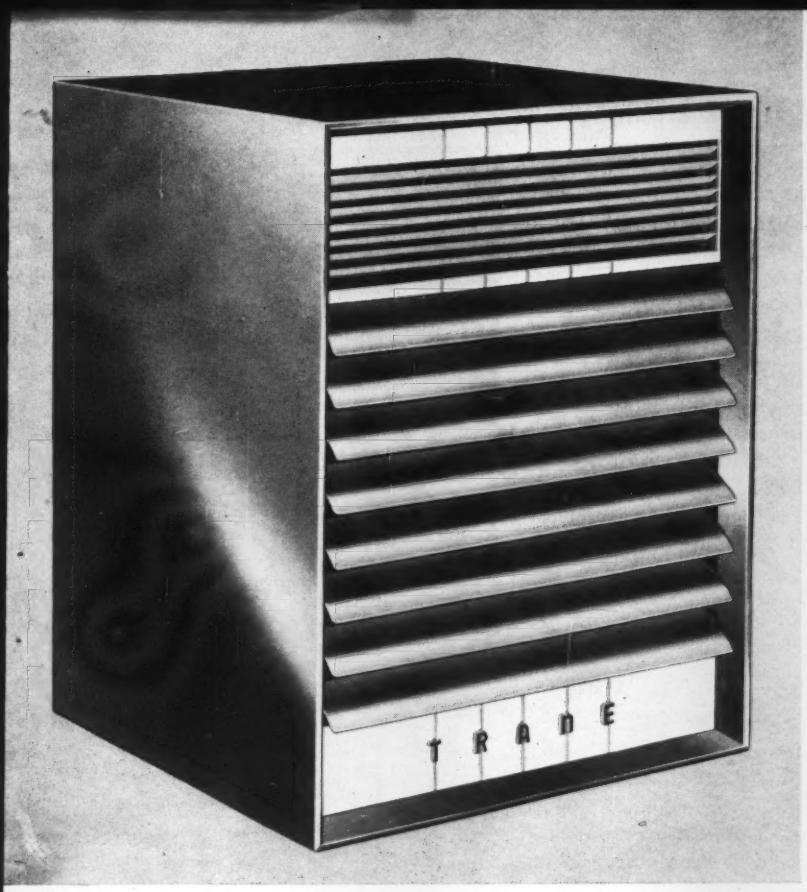
▸ *CENTRIFUGAL PUMPS*—bulletin "M-60" describes unit with canned stator and "flow-through" type rotor-impeller which may be mounted in any position; with schematic diagram, exploded view illustrating all pump parts; for pipelines up to 2 in. diameter, handling capacities up to 115 gpm, discharge heads to 31 ft. *The Corley Co., Inc.*, 685 *Myrtle Ave., Boonton, N. J.*

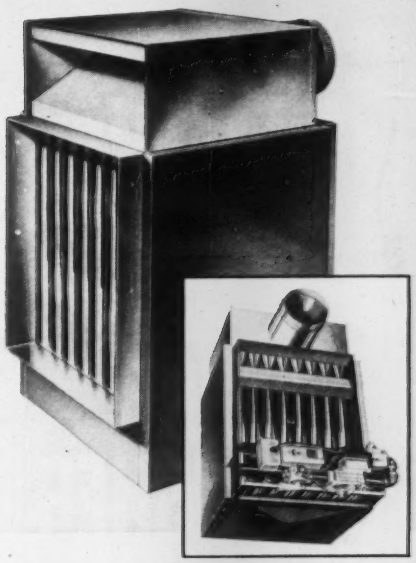
▸ *CHECK VALVE PRESSURE LOSS*—tests conducted by Cornell University Department of Hydraulics on line of 4 in. through 18 in. globe type units detailed in bulletin "659." *The Williams Gauge Co., Inc., Two Gateway Center, Pittsburgh* 22, *Pa.*

▸ *CLAMPS*—for hose, plastic pipe, variety of industrial applications featured in catalog "1-103" with photographs and dimensional drawings of various types offered, plus construction details and recommended uses. *Ideal Corp.*, 435 *Liberty Ave., Brooklyn* 7, *N. Y.*

▸ *COOLING TOWERS*—centrifugal fan type in 5 to 30 ton sizes for horizontal or vertical air flow indoor installations detailed in bulletin "ECKB-601" with charts showing operating and dimensional data plus take-apart dimensional data necessary when installation in inaccessible space is planned. *Halstead & Mitchell Co., Bessemer Building, Pittsburgh* 22, *Pa.*

▸ *CONTROLS AND ACCESSORIES*—including break-glass switches, control stations for mechanically held switches and relays, relay panels for





Duct heater is suitable for downstream operation in accordance with latest codes. Provides heating cycle for remote cooling units, such as the TRANE Self-Contained Air Conditioner. Drain pan (shown in inset) is standard equipment. The unit has low static resistance, is of aluminized construction. Operational modulation valve reduces input as much as 80%. 2-stage, 2-input valve available.

Propeller-type heater uses a new, quiet TRANE Fan that is designed exclusively for unit heaters. Access door on bottom of casing makes unit easy to clean. Complete range of sizes from 33,000 to 250,000 Btuh input.

New Trane gas-fired heaters have advanced styling, compact design!

High-performance blower and propeller units—plus duct models approved for downstream operation

Here's a new line of gas-fired heaters from TRANE that combines smart, modern appearance with peak performance and versatility! These TRANE Heaters are ruggedly built for long life—yet they're light in weight, compactly designed for use where space is at a premium.

Three basic types are available: propeller, duct and blower. All models feature an aluminized steel, all-welded heat exchanger that assures long, trouble-free operation. The steel, ribbon-type burners have stainless steel inserts. And the burners are removable individually for service and maintenance.

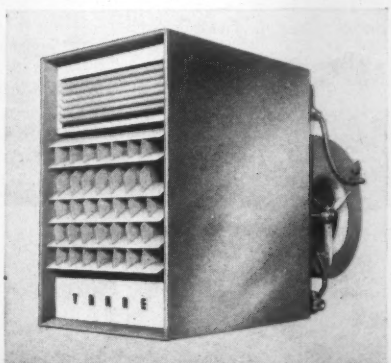
The TRANE Duct Heater may be used for downstream operation, for use with remote cooling units (such as the TRANE Self-Contained Air Conditioner). All parts of the duct heater that are exposed to the cold air stream are of aluminized construction—including the drain pan, which is standard equipment.

True 2-speed, 2-input propeller units available in 5 sizes. The motor speed and gas input can be automatically cycled to maintain more even temperatures; to provide greater operating economy.

The light weight of these new TRANE Heaters means more Btu's per pound. Freight costs are lower; and installation is simplified: minimizes the need for expensive structural reinforcement.

WANT MORE FACTS on these gas-fired heaters? Just ask your nearby TRANE Sales Office; or write TRANE, La Crosse, Wisconsin.

Blower-type heater uses a forward-curved centrifugal fan. Free delivery or duct work installation; adjustable fan belts to provide proper air delivery against varying static pressures. Streamlined fan inlet for exceptionally quiet operation. Louver-Fin Diffusers increase air throw. Sizes from 33,000 to 250,000 Btuh input.



For any air condition, turn to

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MANUFACTURING ENGINEERS OF AIR CONDITIONING, HEATING, VENTILATING AND HEAT TRANSFER EQUIPMENT

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CLEANS AND RESTORES ELECTRICAL CONTACTS ON ELECTRONIC EQUIPMENT

Such as: Relays, Breakers, Solenoids, Thermostats, etc.

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NEWARK, NEW JERSEY

RECENT TRADE LITERATURE

Continued

gas valves, phase sequence correctors, and engine generator isolating switches covered in catalog "57-S7." *Automatic Switch Co., Florham Park, N. J.*

▸ *CONTROL VALVES*—of venturi-ball design, in sizes from ¼ through 14 in., for pressures from vacuum up to 50,000 psi, temperatures from — 425 to 1800 F, supplied with variety of control and positioning equipment, suitable for liquids, gases, vapors, and slurries, detailed in catalog "GV-1-1" *General Kinetics Corp., 197 S. Van Brunt St., Dept C, Englewood, N. J.*

▸ *CORROSION INHIBITOR*—compound for treatment of recirculating cooling water systems, said to provide corrosion control, eliminate sludge deposition, permit more concentration of make-up water, simplify control procedures; covered in bulletin "CSP-935" *Calgon Co., Hagan Center, Pittsburgh 30, Pa.*

▸ *COUPLINGS*—V-band type, for connecting and sealing tubing, piping, ducts, containers, etc., obtainable in any increment from minimum diameter of particular unit to maximum diameter of application; detailed in new brochure. *Aeroquip Corp., Marman Div., 11214 Exposition Blvd., Los Angeles, Calif.*

▸ *DIFFUSER*—for use as integral part of spiral duct installations, is inserted in run of duct in place of coupling, consists of round section with shaped nozzles in variety of patterns, some models equiped with volume damper; detailed in new brochure. *United Sheet Metal Co., Inc., 540 South Drexel Ave., Columbus 9, O.*

▸ *DRAFT CONTROL SYSTEMS*—for monitoring air flow, timing combustion cycle, operating dampers, detailed in bulletins "DC-360" and "DC-3073" which cover all compo-

Babbitt

Adjustable

SPROCKET RIM

with Chain Guide

Changes that Danger Zone to a

SAFETY ZONE

. . . saves you money

ON EVERY VALVE

Every minute saved is money in your pocket. Cut out the waste of time, labor, floor space due to hard-to-reach valves. At the seme time, convert Danger Zones to Safety Zones. Equip every overhead valve in your plant with Babbitt Adjustable Sprocket Rims with Chain Guides for day to day economy.

- They simplify pipe layout.
- They fit any size valve wheel.
- They are easy to install and operate.
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- The first cost is the only cost (no maintenance).
- They are packed completely assembled (one to a carton), with easy-to-follow instructions.
- A hot-galvanized rust proof chain is available for all sizes.

Babbitt Adjustable Sprocket Rims with Chain Guide are carried in stock by most mill supply houses. Just phone your mill supply salesman, or contact us direct.

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STEAM SPECIALTY CO.

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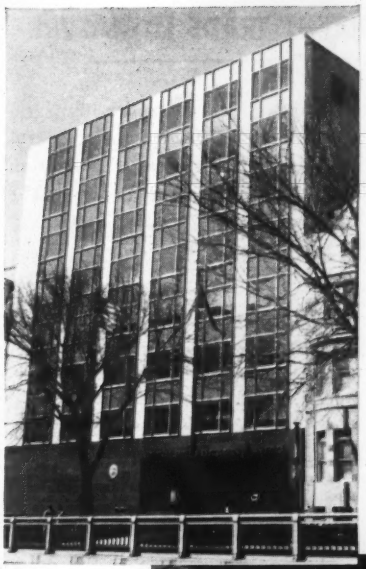


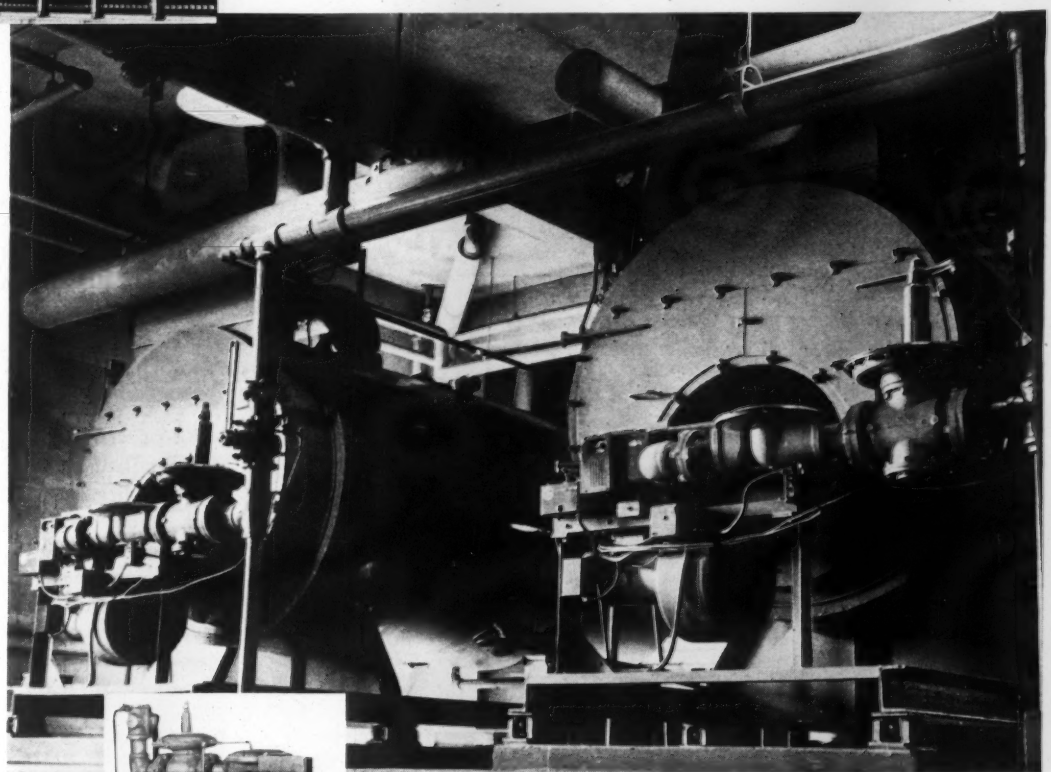
83.8% and 84.5% EFFICIENT!

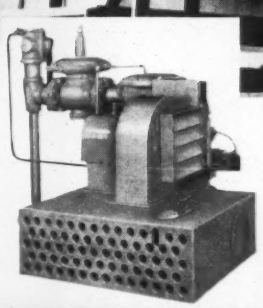
By actual test, this pair of LoBLAST Power Gas Burners in the building of the National Rifle Association of America shows this operating data:

	Boiler No. 1	Boiler No. 2
Input	3,400,000 BTU	3,100,000 BTU
Flue gas temperature	345°F	305°F
CO_2	10.4%	10.6%
Flue loss	16.2%	15.5%
EFFICIENCY	83.8%	84.5%

These amazing efficiencies are the result of Lo-BLAST'S exclusive design and construction features. Lo-BLAST Burners use a quiet, low speed blower to provide perfectly controlled primary and secondary air—completely independent of natural draft. When the burner shuts off there is no rush of draft air to carry heat up the chimney and thus waste fuel. Combustion is completed in an incandescent firebox with radiant heat applied to the crown sheet as well as the side walls.

With a Lo-BLAST Burner installed the need for a high chimney is eliminated. "Inshot" design, with all components outside the firebox, reduces maintenance cost. Every unit is factory tested on gas and shipped assembled, fully equipped with fool-proof safetys.





Lo-BLAST and Economite Power Gas Burners can be installed in any boiler or furnace. They are available in capacities from 70,000 to 20,000,000 BTU input.

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LO-BLAST

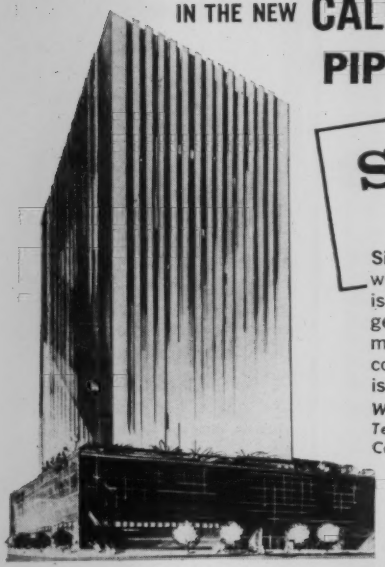
POWER GAS CONVERSION BURNER

MID-CONTINENT METAL PRODUCTS COMPANY

1960 Clybourn Ave., Chicago 14, Ill.

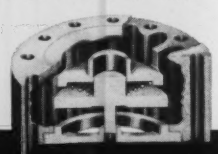
IN THE NEW **CALIFORNIA BANK** BUILDING

PIPING SYSTEMS ARE **SAFE and SILENT!**



Silent Check Valves operate instantly when flow reversal starts or when flow is zero. In this handsome new Los Angeles structure, as in hundreds of other major buildings — surge pressures are controlled, troublesome water hammer is eliminated.

Write for Bulletins: No. 659 on Pressure Loss Tests . . . No. 654 on Valves . . . No. 851 on Cause, Effect and Control of Water Hammer.



Williams-Hager *Silent* CHECK VALVES

General Contractor
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Plumbing Contractor
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Twenty-seven 2-inch holes through reinforced concrete *18-41 inches thick*—that was the job to be done on a bridge project. Using one Longyear diamond drill, a contractor completed the work in a few days at low cost despite the fact that *the bit was cutting steel 10% of the time.* The job was finished on schedule with Longyear diamond drilling equipment. *What other type of drilling equipment could have done this work at justifiable cost?* Call your Longyear dealer to find out about the great advantages and applications of Longyear diamond bits and the all-new industrial drills.

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RECENT TRADE LITERATURE
Continued

nents and draft controller unit, respectively; with description of operation, standard models, application data. *Cleveland Controls, Inc.*, 1111 *Brookpark Rd., Cleveland* 9, *O.*

▸ *ELECTRIC CHECK VALVE*—described in bulletin "W-10A" which lists advantages claimed over other types of units, gives dimensional details, suggested wiring diagram, sequence of operation, typical installations. *Golden-Anderson Valve Specialty Co.*, 1210 *Ridge Ave., Pittsburgh* 33, *Pa.*

▸ *ELECTRONIC INSTRUMENTS*—new brochure describes electronic and electromechanical instrument systems capabilities including applications for position indicating equipment and other precision uses; with descriptions of products and services available, examples of indicating and control systems and components firm has supplied for industrial and other users. *The Liquidometer Corp.*, 37-15 *Skillman Ave., Long Island City* 1, *N. Y.*

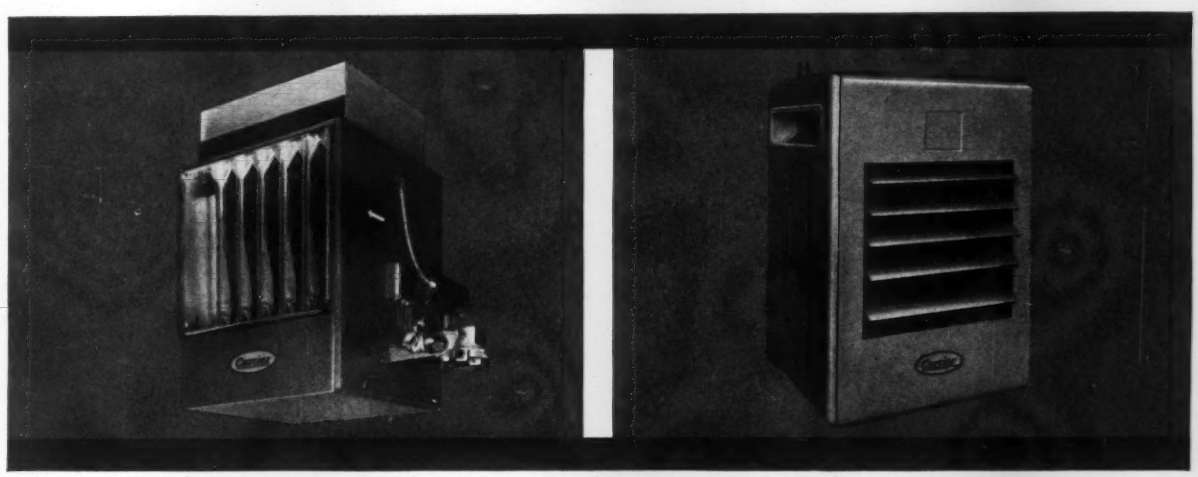
▸ *FAN-COIL UNITS*—for heating and ventilating in nine sizes for low static applications and seven sizes for high static operations, nominal capacities from 1250 to 15,000 cfm described in catalog "575" with selection data charts, dimensional and arrangement data, and engineering specifications. *McQuay, Inc.*, 1600 *Broadway St. N.E., Minneapolis* 13, *Minn.*

▸ *FUEL UNITS*—for oil burners, single and two stage, covered in current issue of "Facts 'n Figures" quarterly publication; with information on operation and servicing, line sizing for two-pipe installations, facts on fuel unit performance aimed at achieving maximum oil burner efficiency. *The Carlin Co.*, 912 *Silas Deane Highway, Wethersfield, Conn.*

▸ *GAS COMBUSTION EQUIP-*

Carrier announces new duct furnaces and gas-fired unit heaters

with heat exchangers of durable jet-age Strato-Steel!



NEW DUCT FURNACES available in 8 sizes with individual capacities from 50,000 to 250,000 Btu/hr. Designed for multiple installations of over 1,000,000 Btu/hr. A.G.A. approved.

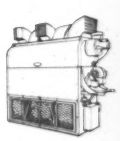
NEW GAS-FIRED UNIT HEATERS available in 9 sizes with capacities from 25,000 to 225,000 Btu/hr include as standard equipment many features usually offered as accessories. A.G.A. approved.

Here's an advance that assures your customers better performance than ever in these two new Carrier lines. It's Strato-Steel—a completely new material developed for the exhaust pipes of supersonic jet aircraft. Used in the heat exchangers in every model of Carrier's new heaters, Strato-Steel provides a new standard of protection against high temperatures and corrosion. Along with new design, it provides new economy and efficiency of operation.

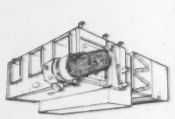
Whatever the job, large or small, there's a new Carrier Furnace or Unit Heater to handle it to your customers' satisfaction and your profit. For complete specifications on the new products, get in touch with your Carrier Wholesaler. His number is listed in the Yellow Pages under "Heaters—Unit." Or write direct to Carrier Air Conditioning Company, Syracuse 1, N. Y.

Carrier offers every type of equipment for any commercial or industrial job

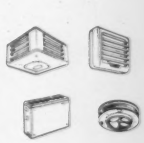
Carrier



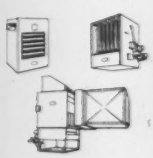
Heat Diffusers—Direct Fired for gas or oil



Heating and Ventilating Units for steam and hot water



Unit Heaters for steam and hot water



Gas Unit Heaters and Duct Furnaces

FREE BOOKLET SHOWS HOW TRANSITE® PIPE CUTS COSTS IN STORM WATER DRAINAGE & STORM SEWER SYSTEMS

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Please send me, without obligation, your facts and data booklet on Transite Pipe Storm Water Drainage and Storm Sewer Systems.

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ADDRESS_____

CITY_____ ZONE_____

COUNTY_____ STATE_____

RECENT TRADE LITERATURE

(*continued from page* 206)

MENT—fold-out catalog illustrates burners and mixers, plus blowers and accessory items in additional section; with description of full line of burners, mixers, pilots, regulators, blowers, valves and accessories, data on size range, capacity, and suggested applications; items are indexed for ease in obtaining additional data sheets. *Bryant Industrial Products Corp.*, 17700 *Miles Ave., Cleveland* 28, *O.*

▶ *GATE VALVES* — of ductile iron construction covered in illustrated bulletin with dimensional charts, pressure-temperature ratings table, standards citation. Valves are 2 in. through 12 in. sizes. *Crane Co.*, 836 *S. Michigan Ave., Chicago* 5, *Ill.*

▶ *GLOBE AND GATE VALVES* — of forged steel are detailed in four new folders (GP-5, GP-4, GP-8, SS-1) which cover welded bonnet types in ¼ through 2 in. sizes for 150 to 800 lb service, bolted bonnet and gland type gate valve for same service and in same sizes, plus gate and globe valves with bolted bonnet and inside screw, and stainless and alloy steel globe, gate, and check valves and fittings; line is available with screw or socket weld ends. *Henry Vogt Machine Co., Dept.* 24 *A-FHP, Louisville, Ky.*

▶ *HEAT EXCHANGERS* — 3 in. low pressure double pipe, featured in bulletin "110" with discussion of forged hammer type head to tube closure, forged flanges, minimum bolting design, plus description of integral "one-piece" fintube construction, notes on thermal and mechanical efficiency, materials of construction and sizes; brochure includes cutaway photographs, specification drawings and tables of dimension. *Brown Fintube Co.*, 300 *Huron St., Elyria, O.*

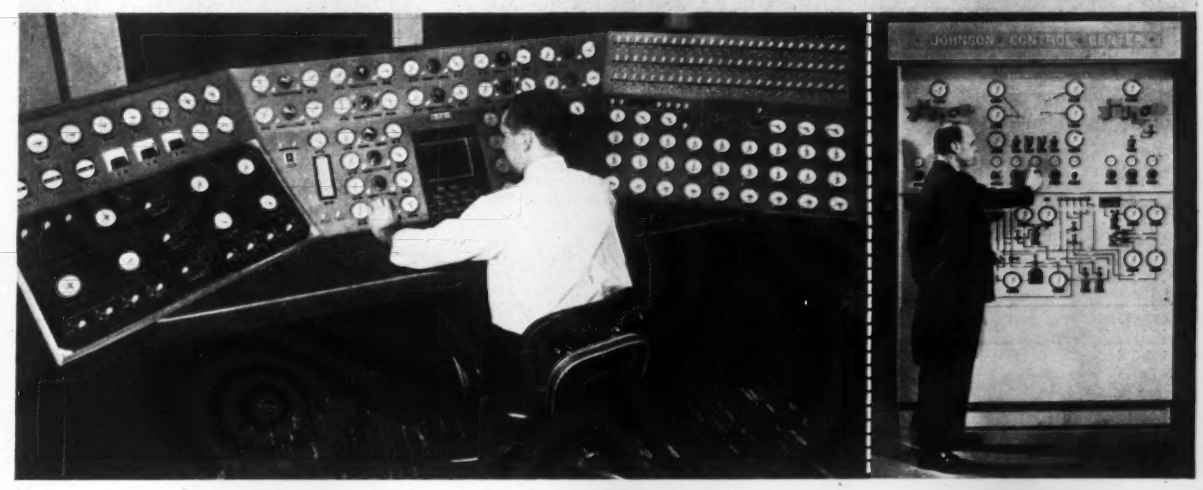
▶ *HIGH TEMPERATURE HOT WATER GENERATORS* — bulletin "G-92" describes various applications of two systems designed by manufacturer utilizing conventional water tube steam boilers or forced circulation boilers. *The Babcock & Wilcox Co., Boiler Div.*, 161 *E. 42nd St., New York* 17, *N. Y.*

▶ *HOSE FITTINGS* — illustrated catalog covers line of low pressure re-usable hose fittings, couplings, union swivel adapters, oxygen and acetylene couplings and connectors, male and female stems, joiners, one and two rayon braide hose, others. *The Lenz Co.*, 3301 *Klepinger Rd., Dayton* 1, *O.*

▶ *IMMERSION HEATING* — and cooling with prefabricated coils and panels featured in bulletin "M-11" illustrating various types of standard and special "double-embossed" panels available; cross-flow, extra long, self draining, cylindrical, multiple bank and other types are detailed. *Dean Products, Inc.*, 1048 *Dean St., Brooklyn* 38, *N.Y.*

Johnson Temperature & Air-Conditioning Control Sets the Pace...

PUT THE ACCENT ON EFFICIENCY!



At left is a console-type Johnson Pneumatic Control Center installed in the National Bank of Detroit. Albert Kahn Associated Architects & Engineers, Inc. Panel at right is installed in the First Presbyterian Church, Elkhart, Indiana. Wiley & Miller, architects; Bevington, Taggart & Fowler, mechanical engineers.

JOHNSON PNEUMATIC CONTROL CENTERS provide the convenience and economy of centralized supervision and control of air conditioning at a lifetime cost unmatched by other types of control. *The instrumentation is as simple, trouble-free, and dependable as the pneumatic controls used elsewhere in a building!* And exclusive operational features compound the savings! Each panel is custom planned to meet the specialized needs of the individual building. Ask your local Johnson representative to explain in detail how Johnson Pneumatic Control Centers can add to the efficiency of your clients' buildings. Johnson Service Company, Milwaukee 1, Wisconsin. 105 Direct Branch Offices.

JOHNSON CONTROL

PNEUMATIC SYSTEMS

DESIGN • MANUFACTURE • INSTALLATION • SINCE 1885

TEMPERATURE & AIR-CONDITIONING CONTROL SYSTEMS FOR COMMERCIAL, INDUSTRIAL & PUBLIC BUILDINGS – AND SHIPS

RECENT TRADE LITERATURE

Continued

▸ *INDICATING INSTRUMENTS* — for boiler operation, adjustment of firing equipment and controls, including multi-pointer gages for indicating draft, air pressure, and pressure differential, single-pointer gages for individual indication of those functions, detailed in bulletin "G-260" with description of operating mechanism, typical applications, range and mounting tables; also covers flue temperature and smoke indicator devices. *Cleveland Controls, Inc.*, 1111 *Brookpark Rd., Cleveland* 9, *O.*

▸ *INDUSTRIAL ADHESIVES* — for bonding metals, rubbers, plastics, fabrics, other materials are detailed in new brochure with information on principal uses and characteristics of representative formulations offered, plus section on solvent base, water base and hot melt adhesives. *Bostik Adhesives, B. B. Chemical Co.*, 784 *Memorial Dr., Cambridge, Mass.*

▸ *INDUSTRIAL HYGIENE FOUNDATION* — and its services described in illustrated brochure released on the occasion of the organization's 25th anniversary, with notes on toxicological research facilities, informational services. *Industrial Hygiene Foundation, Mellon Institute*, 4400 *Fifth Ave., Pittsburgh* 13, *Pa.*

▸ *INDUSTRIAL INSULATION* — brochure lists all types offered for use in various industries, including calcium silicate and mineral wool block varieties for temperatures up to 1900 F, plus description of "Careytemp" insulation for heat resistance up to 1600 F; with tabular product selection guide which indicates applications for high temperatures, high, medium, and low pressure steam lines, cold water piping, heating and air conditioning ducts, others. Form "6451." *Philip Carey Mfg. Co.*, 320 *S. Wayne Ave., Cincinnati* 15, *O.*

▸ *INFRARED HEATERS* — and ovens for wide variety of industrial applications described and illustrated in bulletin "BRG100"; equipment consists of components, modular oven sections, and vertical, horizontal, portable, tower, ore car thawing, and monorail or floor-type conveyor ovens designed for basic commercial and industrial operations. *Radcor, Inc., Bradner, O.*

▸ *LIQUIFIED GASES* — booklet covers principles and techniques of handling, storing, and converting liquified oxygen, nitrogen, and argon with discussion of uses, advantages of liquid-state storage, and equipment used. Form "ADC 935." *Air Reduction Sales Co., Div., Air Reduction Co., Inc.*, 150 *East* 42*nd St., New York* 17, *N.Y.*

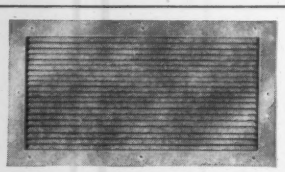
▸ *MAKE-UP AIR HEATERS* — including gas fired units with capacities from 15,000 to 90,000 cfm, 1 to 7 million Btu per hr; horizontal and vertical discharge steam-fired units with capacities from 4000 to 36,000 cfm, 380,000 to 2,642,000 Btu per hr at 5 lb steam pressure; with construction and control details, per-

you can be sure of quality . . . craftsmanship with

AGITAIR® REGISTERS and GRILLES

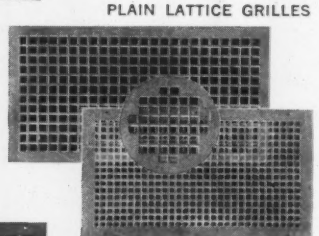
AGITAIR registers and grilles are available in a wide range of sizes and styles to meet every requirement of the architect and designer.

Available in all aluminum, stainless steel, bronze, brass, standard steel and plated finishes. Finish thoroughly baked on hard. Will not chip. When you specify these AGITAIR units, you are specifying quality items.



SIGHT TIGHT GRILLES

PLAIN LATTICE GRILLES



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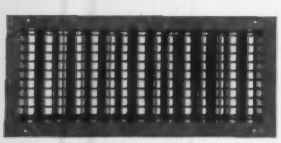
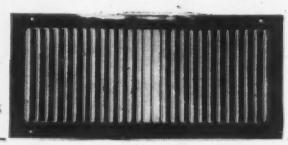
with a selection of modern designed borders



REGISTERS

Ask your AGITAIR representative for your copy of catalog or write to Air Devices Inc.



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AIR DISTRIBUTION • AIR CLEANING • AIR EXHAUST

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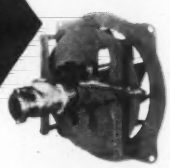
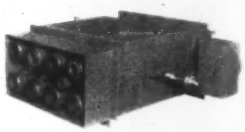
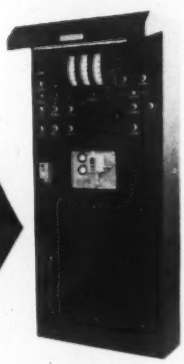
BUILDS BOTH

GAS and/or OIL BURNERS





and CONTROL CENTERS



Webster can take full responsibility for a complete system.

WEBSTER ENGINEERING
Division of Midland-Ross Corp.
TULSA 9, OKLAHOMA
M-R

RECENT TRADE LITERATURE
Continued

formance data and dimensions. Bulletin "A-117." *Hartzell Propeller Fan Co., Piqua, O.*

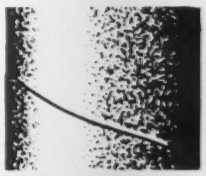
▸ *METERS, FEEDERS, CONTROLS* — including butterfly valves, supervisory control systems, totalizing meters, water and waste treatment equipment and systems, flow meters, process instrumentation, solid and liquid feeders and liquid blenders are covered in general bulletin "0001.20-1" *B-I-F Industries, P.O. Box* 1342, *Providence* 1, *R. I.*

▸ *OIL BURNERS* — two bulletins, "100" and "25A" feature respectively, pressure atomizing unit for Nos. 4 and 5 fuels, 10 to 30 gph capacity, with electric preheater, integral control cabinet, gear type fuel pump, furnished as package; and dual stage mechanical and steam atomization burner for connection to fuel pump and steam or compressed air supplies; the latter burner unit is available in three sizes for 15 to 100 psi steam pressures, 140 to 150 psi fuel pressures for normal ratings, or for up to 300 psi fuel pressures for operation at up to 900 gph. *National Airoil Burner Co., Inc.*, 1284 *E. Sedgley Ave., Philadelphia* 34, *Pa.*

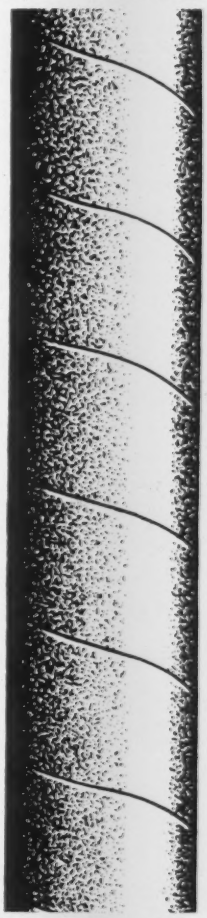
▸ *PACKAGED AIR CONDITIONERS* — in 10 through 30 hp models for commercial and industrial applications featured in bulletin "6022" with cutaway drawings for analysis of fan sections, filters, cooling coils, controls, condensers, strainers, receivers, compressors, other components; plus sections on accessories, capacities, dimensional data, piping diagrams, ratings, wiring. *Dunham-Bush, Inc.*, 179 *South St., West Hartford, Conn.*

▸ *PIPE INSULATION* — for service from below zero to 350 F described in bulletin "J-660" which presents information on mineral fiber composition, thermal conductivity, available sizes and thicknesses including

Specialists in Low Loss Components for High Velocity Systems



SPIRAL
PIPE AND FITTINGS
For Air Movement



spiral pipe division
United
SHEET METAL COMPANY INC.

883 N. Cassady Ave. Columbus, Ohio
1227 Beighle St. Stockton, California

RECENT TRADE LITERATURE
Continued

those for copper tubing, and recommended thickness table based on desired heat loss; also described are seven factory applied facings available. *Baldwin-Ehret-Hill, Inc.*, 500 *Breunig Ave., Trenton* 2, *N.J.*

▶ *PIPE INSULATION* — for refrigeration and chilled water lines, dual temperature lines, and heated lines up to 220 F presented in folder with product data and specifications on flexible foamed plastic material; includes technical data book containing insulation thickness selector, equivalent thickness chart, and heat loss tables; folder includes data on same material in sheets. *Armstrong Cork Co., West Liberty St., Lancaster, Pa.*

▶ *PIPE INSULATION* — of multicellular plastic foam described and illustrated in folder which cites low thermal conductivity and vapor absorption properties, light weight, high compressive strength, resistance to adverse environmental conditions; with list prices, sample order form, illustrations of installations. *M-M-M Inc.*, 1315 *Hutchins, Houston* 1, *Texas.*

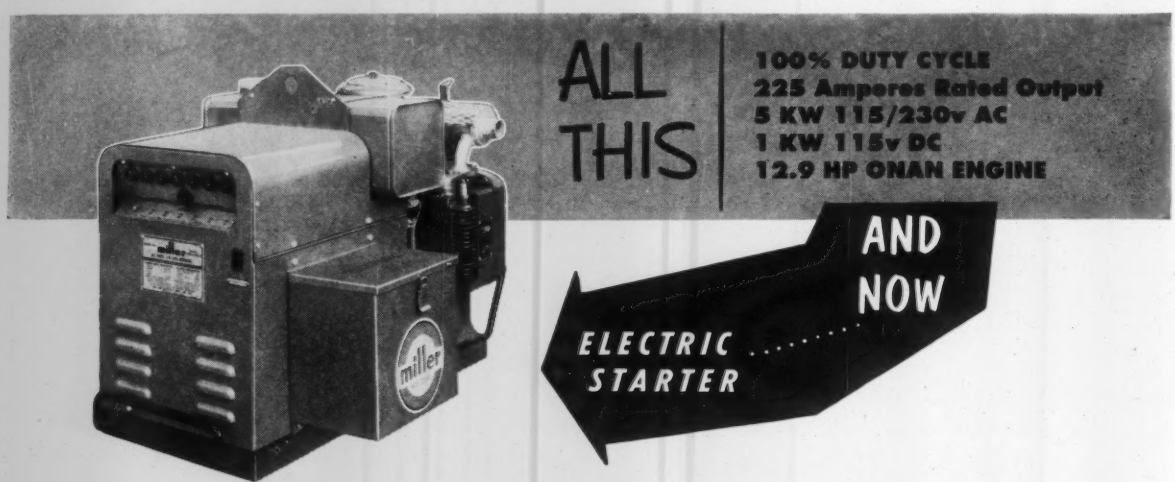
▶ *PIPELINE STRAINERS* — for lube oil, hydraulic, or air pipe systems said to remove contaminants such as pipe scale, core sand, metal chips, or construction dirt; may be inserted in lines at existing flange joints or by special flanged housing; for maximum temperatures of 250 F, featured in new bulletin. *Air-Maze Corp.*, 25000 *Miles Rd., Cleveland* 28, *O.*

▶ *PIPELINE STRAINERS* — in four basic types for condensate, steam, water, oil, air, gas, and other piped fluids, covered in bulletin "1210" with construction details, operating features, special emphasis on cast steel unit for pressures up to 600 psi. *Sarco Co., Inc.*, 635 *Madison Ave., New York* 22, *N.Y.*

▶ *PIPELINE STRAINERS* — Y-type, in $\frac{1}{4}$ in 2 in. sizes, cast iron, bronze, or carbon steel, with screwed end connections, featured in data sheet "2000." *Frank D. Riggio Co., Inc., State Highway* 17, *Rutherford, N.J.*

▶ *PNEUMATIC CONTROLLERS* — indicating, for pressure, vacuum, liquid level, flow, temperature, and humidity applications featured in bulletin "DM058" with illustrations of components, performance chart, range limit and model number tables for various units. *The Bristol Co., P.O. Box* 1790, *Waterbury* 20, *Conn.*

▶ *PNEUMATIC SWITCHES* — for variety of applications in combustion, air conditioning, industrial processing, operate on diaphragm principle, are described in bulletin "AS-3074" with diagrams of negative or positive pressure and differential applications, list of features, model-features-application chart. *Cleveland Controls, Inc.*, 1111 *Brookpark Rd., Cleveland* 9, *O.*



The world-wide respect and demand for this original Miller gas engine driven welder/power plant has never been greater. To this established popularity has now been added the convenience of Bendix drive electric starting as optional equipment on models AEA-200-L and AEA-200. Model illustrated and headlined is AEA-200-LE.

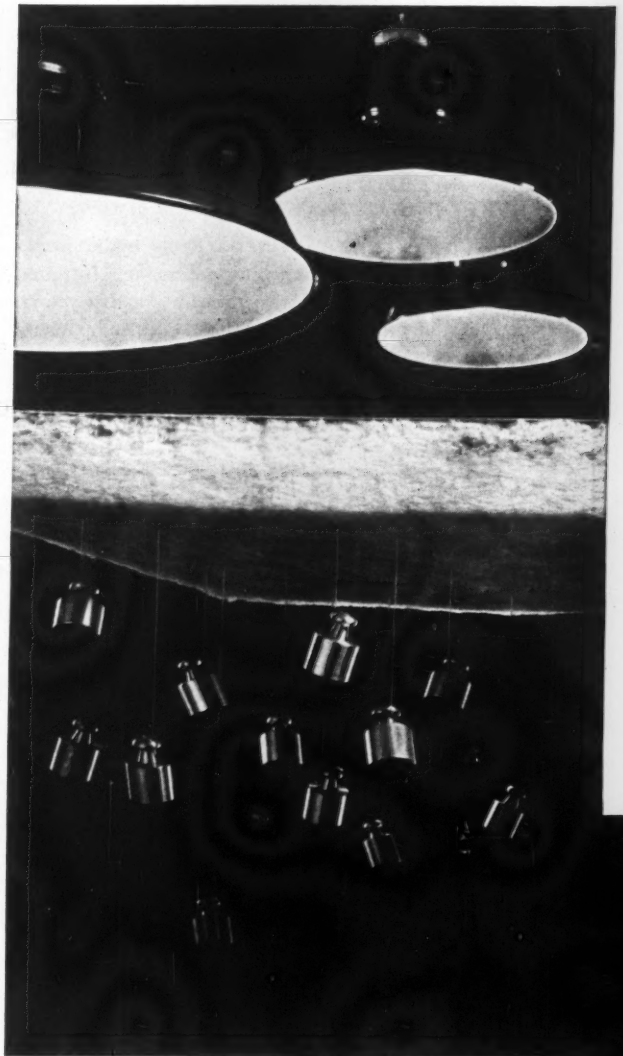
As a welder, as a power plant, as a pipe thawer, indeed, as a top hand from Canadian uranium mines to Brazilian cattle ranches — and on highway construction jobs and repair ships between — the AEA-200-L stands quite alone as "the finest in the field." In addition to optional electric starter, road trailers and rubber tired running gear are also available.

Other Miller gas engine driven DC and AC-DC welder/power plants to 300 amperes at 100% duty cycle. Full particulars will be sent promptly upon request, or a demonstration can be arranged at your convenience.

miller Electric Manufacturing Company, Inc., APPLETON, WISCONSIN

EXPORT OFFICE 250 West 57th St., New York 19, N.Y. • Distributed in Canada by Canadian Liquid Air Co., Ltd., Montreal

3M Brand Adhesives and Sealers answer these insulation needs...



HIGH HEAT RESISTANCE. Rugged Adhesive EC-1128 holds tight despite temperatures as high as +300° F. And it resists moisture so that steam can't loosen the bond! Even when temperatures drop to —20° F, it still holds insulation to the duct. What's more, EC-1128 provides instant grip . . . yet plenty of open time to let you position the insulation without rushing. With EC-1128 you can also bond lapped foil-to-foil seams to keep insulation dry for top performance.

FLEXIBILITY. Resilient Sealer EC-800 stays rubbery, flexes with duct expansion and contraction. It's ideal for high velocity systems! Sets up firmly at duct joints; won't flow out of seams under pressure. Apply EC-800 with brush, flow gun or putty knife. Once dry, EC-800 forms a tight seal that actually adds structural strength to duct work.

SEE WHAT 3M ADHESIVES CAN DO FOR YOU. Contact your 3M Field Engineer. Or, for more information and free literature telling how time-tested 3M Brand Adhesives and Sealers can help to solve virtually all your insulation installation problems, write on your company letterhead to: A. C. & S. Division, 3M, Dept. SBI-80, 900 Bush Avenue, St. Paul 6, Minnesota.

ADHESIVES, COATINGS AND SEALERS DIVISION

MINNESOTA MINING AND MANUFACTURING COMPANY

...WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY

usAIRco

40 years experience in air handling units

Series 73 Heating, Ventilating Unit

RUGGED CONSTRUCTION

Built for Efficient Performance, Long Life and Trouble-Free Operation

WRITE FOR PRODUCT BULLETIN 73

United States Air Conditioning Corporation
Delaware, Ohio

RECENT TRADE LITERATURE

Continued

▸ *POWER TOOLS* — for wide variety of uses covered in new bulletin which lists 81 types including saws, drills, routers, sanders, shears, drivers, grinders, pneumatic tools, abrasive products, others. *Skil Corp.*, 5033 *Elston Ave., Chicago* 30, *Ill.*

▸ *PREFABRICATED DUCT SILENCERS* — bulletin "B-5" outlines selection factors, illustrates models available, contains acoustic and pressure drop data for various sizes. *Silence, Inc., P.O. Box* 21, *Farmingdale, N.Y.*

▸ *PUNCHES, SHEARS, PRESSES* — hydraulically operated models for punching, shearing, forming, notching, bending, coping, squeezing, and riveting, plus portable or bench mounted hand operated punches and presses and accessories for all models are detailed in catalog "60." *W. A. Whitney Mfg. Co.*, 636 *Race St., Rockford, Ill.*

▸ *REDUCING/RELIEF VALVE* — in ⅛ and ¼ in. sizes designed for initial pressures of 4000 psi with water, oil, air, or gas, detailed in new catalog sheet; valve is single-seated, spring-loaded, diaphragm actuated, with adjustable pressure ranges of 0 to 1000, 2000, and 3500 psi, for process or test applications requiring small capacity high pressure supply. *Atlas Valve Co.*, 280 *S. St., Newark* 5, *N.J.*

▸ *ROOF VENTILATORS* — of spun aluminum, centrifugal and propeller type in sizes from 190 to 8754 cfm, pressure ranges of 0 to 2 in. WG detailed in new folder. *Octagon Ventilator Co., P.O. Box* 1127, *Jackson, Tenn.*, or 5828 *S. Oakley Ave., Chicago* 36, *Ill.*

▸ *SEAMLESS TUBING* — available in most metals is processed in strip form and rolled up for compact shipment, after which mechanical means are used to expand the strip to tubular form; covered in new brochure which lists alloys, describes method of fabrication, gives size ranges and other information. Called "Strubing." *Wolverine Tube, Div. of Calumet & Hecla, Inc.*, 17200 *Southfield Rd., Allen Park, Mich.*

▸ *SERVO-AMPLIFIER* — d-c to a-c with matched impedance motor, suitable in self-balancing instruments or for control instrumentation where a transducer produces a change in voltage or resistance is covered in bulletin "91" with specifications, operational principles, dimensions, block diagram, description of special features for various applications. *Thermo Electric Co., Inc., Saddle Brook, N.J.*

RECENT TRADE LITERATURE

Continued

▶ *STEAM HEATING CONTROLS* — called "Steam Mizer" meters system by controlling steam pressure at system inlet, consists of outside and inside temperature transmitters, control pilot, diaphragm control valve, adjustable vacuum switch, is described and diagrammed in folder which lists advantages gained, presents steam rate/probable savings chart. *Delta Controls Corp., 5 Beekman St., New York 38, N.Y.*

▶ *STEAM TRAPS* — catalog "FE-310" provides information on line of bi-metal thermostatic and float thermostatic units in variety of pressure ranges, body patterns, sizes, and connections, describes stainless steel bi-metal thermal element said to provide precise control, continuous throttling, minimum steam loss. *Farris Engineering Corp., MIL Div., 563 Commercial Ave., Palisades Park, N.J.*

▶ *TEMPERATURE REGULATORS* — self-contained, in several types, discussed in bulletin "502" with capacity charts tabulated in terms of gallons of water heated and lb steam consumed at different steam pressures. *Thomas P. Bruno, Warren Engineering Co., Div. of Warren Automatic Controls Corp., Main St., Broadway, N.J.*

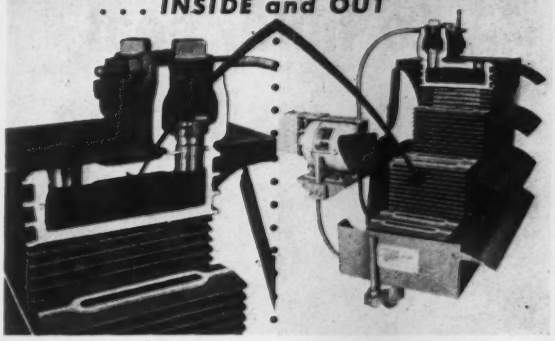
▶ *THERMOCOUPLE ASSEMBLY* — iron-constantan and chromel-alumel swaged units with magnesium oxide insulation described in product specification sheet "E51-8" with dimensional drawings, quotation-ordering information. *Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, O.*

▶ *THERMOCOUPLES* — bulletin "P1281A" describes metal-sheathed, ceramic insulated construction, with application information, ordering tables listing available types, dimensions, other specifications. *The Bristol Co., Waterbury 20, Conn.*

▶ *THERMOCOUPLES* — small diameter mineral-insulated units covered in catalog "G 100-4" with ordering information including prices on bulk material, elements, and complete assemblies, with illustrations and construction specifications. *Minneapolis-Honeywell Regulator Co., Industrial Div., Wayne and Windrim Aves., Philadelphia 44, Pa.*

it's the material that makes the difference . . .

. . . INSIDE and OUT



CORROSION causes heating equipment failures!

BUT NOT WHEN YOU USE

GRID

cast iron construction

▶ UNIT HEATERS
▶ BLAST HEATERS
▶ RADIATORS

Designed for operation on steam pressure up to 250 PSI 450° temperature

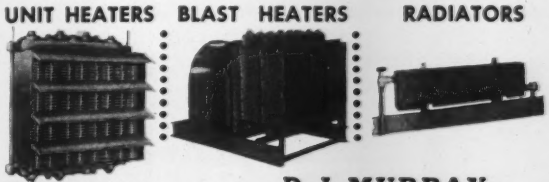
CORROSION internally, caused by electrolytic action is eliminated because all metals in GRID Cast Iron Transfer Surface in contact with steam are similar . . . not 2 or 3 different metals that promote CORROSION that causes leaks and breakdowns . . . do away with high maintenance costs, repair work, and leaky heating equipment.

CORROSION externally caused by acid fumes cannot destroy GRID's cast iron finned heating surface. Widely spaced fins cast integral with the steam chamber will not corrode externally.

ORDINARY HEATING SURFACES FAIL BECAUSE OF CORROSION INSIDE AND OUT! AVOID THESE COSTLY HEATING FAILURES!

Send for Catalog 956R-4-160 . . . The complete story on Grid Unit Heaters, Blast Heaters and Radiators.

UNIT HEATERS BLAST HEATERS RADIATORS



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D. J. MURRAY MANUFACTURING CO.
Manufacturers Since 1883
WAUSAU, WISCONSIN
OFFICES IN PRINCIPAL CITIES

Fast, low-cost way to hold, seal duct insulation

Shuford's SHURTAPE® LF-65

Aluminum foil laminated to 40 lb. Kraft

You'll save time and your job will look neater when you install air conditioning and heating duct insulation with Shuford's SHURTAPE LF-65.

Used instead of staples, this easy-to-apply, pressure-sensitive tape cuts installation costs. It is inexpensive and the shining silver foil backing provides an inconspicuous seal with an excellent finished appearance.

SHURTAPE LF-65 stays put, too. It has high adhesion, excellent resistance to water and abrasion, and no measurable moisture vapor transfer rate. Use it for all types of holding and sealing applications where a shining silver tape is desired.

For free sample roll and complete information, write

Shuford Mills, INC SINCE 1880 HICKORY, N C

CLOTHES LINES • TWINES
PRESSURE-SENSITIVE PAPER TAPES
SASH CORDS • WEATHER STRIPPING
COTTON & RAYON YARNS • EXTRUDED PLASTICS

World's Largest Manufacturer of Cotton Cordage

4113

RECENT TRADE LITERATURE

Continued

▸ *THRUST BEARINGS* — cylindrical roller type featuring retainers of specially developed ferrous material said to reduce tendency for surface "welding" between roller and retainer pocket detailed in catalog "PT-659". *Rollway Bearing Co.*, 541 *Seymour St., Syracuse, N.Y.*

▸ *TORQUE CONTROL UNIT* — operates off standard reversible electric drills or tappers for tube rolling to control amount of expansion on tubes ¼ through 4 in. OD, is featured in bulletin "AC-74". *The Gustav Wiedeke Co.*, 1833 *Richard St., Dayton, O.*

▸ *TUBING MACHINE* — bulletin "401" illustrates and describes bench type model for simultaneous deburring, facing, and chamfering operations on tube or pipe up to 2 in. diameter, cites features such as one-piece head frame, interchangeable chuck inserts and tool holders, quick-change 8 speed drive, single operating lever, others; also covers larger floor mounted models with capacities up to 3 or 5 in. *Pines Engineering Co., Inc.*, 601 *Walnut St., Aurora, Ill.*

▸ *TUBING SELECTION GUIDE* — for steel tubing arranged according to finish, analysis, formability, machinability, weldability and relative cost is afforded through comparative listing of seamless and welded round, square, and rectangular types in bulletin "12-10." *Joseph T. Ryerson & Son, Inc., Box* 8000-*A, Chicago* 80, *Ill.*

▸ *TUBING TOOLS* — catalog "3121" shows over 75 models and kits for cutting, flaring, bending, reaming, swaging, pinch-off, refacing, and sizing, plus data on accessories; with replacement parts list, Federal specifications, information on 25 new items including benders, flaring tools, and cutters. *The Imperial Brass Mfg. Co.*, 6300 *W. Howard St., Chicago* 48, *Ill.*

▸ *VALVES* — foot, line check, union swing check, globe, and angle types featured in new catalog with information on firm's new plastic disc retainer guide. *White Flomatic Div., Flomatic Corp., P.O. Box* 267, *Hoosick Falls, N.Y.*

▸ *WASTE HEAT BOILERS* — bulletin "1700" contains engineering drawings and specifications on line of forced recirculation generators which utilize waste heat from industrial and process sources by means of high velocity circulation through small diameter tubes with orifice flow control. *International Boiler Works Co.*, 115 *Oak St., East Stroudsburg, Pa.*

Air Conditioned Schools

Continued from page 42

research project to develop a secondary school which would provide new answers to the old problems of achieving a superior environment at lower cost.

We interviewed extensively in the project, and called the study Environment for Learning (EFL).

We used a school of our design in Bellaire, Texas, for comparison. Bellaire is a part one-story and part three-story natural ventilation plan with similar facilities for a similar number of people. The EFL plan is for a one-story, controlled environment building, which groups all perimeter activities around the central basic teaching core, permitting the use of a long-span, loft type building which allows maximum freedom of use for any curriculum.

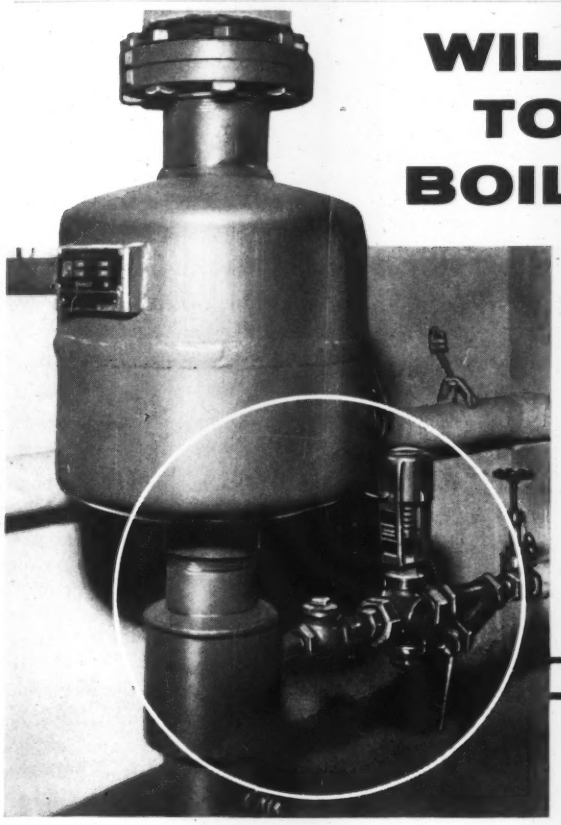
The more compact EFL plan gave more parking space, eliminated costly drainage, and reduced exterior maintenance. Teaching within the building is not controlled by construction limits, ventilation or illumination orientation, or limited space shapes. Nondependence upon natural light sources means that the quality and quantity of illumination can be varied for the tasks at hand.

We moved the glass walls indoors, with the result that sun load through windows is no longer a variable in different rooms. Therefore the high velocity dual duct air conditioning system requires only simple and inexpensive controls. The peak load of 400 tons for the system is about half that normally required for this size school in Houston. Heat from lights and personnel handle building needs down to 20 F outside temperature, so heating requirements are small.

The compact design of the building allows for shorter plumbing and electric runs. External noise is eliminated and interior noise controlled when doors can be kept closed without discomfort.

EFL's exterior wall area was 55 percent less than that of Bellaire school, yet the floor area was reduced by only 7 percent and provided the same amount of useful teaching space. A careful estimate of construction costs still showed that EFL could be built at a saving of more than 20 percent. The difference in owning and operating costs using an amortization period of 30 years indicated that EFL would save a total in excess of $955,000.

In a nuclear age it is well to note that EFL could be built underground with comparative ease. With appropriate above-ground baffles and controls, and adequate supplies, such an installation could provide protection against fallout hazard. In this connection, it might be more practical to supplement local funds with Civil Defense aid for those features which would provide such protection, rather than to construct single separate function structures.



WILSON'S ANSWER TO ECONOMICAL BOILER BLOWDOWN

A Wilson Centrifugal Blowdown Separator is easy to install —requires no maintenance—instantaneously clears steam flash through the large top vent pipe. Water and sludge fall by gravity through bottom drain. No objectional noise.

To reduce temperature of blowdown before entering sewer, Wilson also provides an economical, easy to install *aftercooler*. No maintenance here, either.

(Shown in the circle) Wilson Aftercooler with thermostatic valve for controlling water supply in the drain—extra equipment available from Wilson.

ASK ABOUT the Wilson Centrifugal Blowoff Separator for high pressure hot water relief valve installation.

Write for new Bulletin!

Dept. H-80

WILSON ENGINEERING CORPORATION

6 North Michigan Ave., Chicago 2, Illinois

FOR MAXIMUM HEATING
OR EXHAUSTING EFFICIENCY
AT LOWEST COST

Patents 2,722,372 and 2,855,874 and Patents Pending plus Exclusive Foreign Patents.

...Specify

Quickdraft

POWER-DRAFT UNITS
DESIGNED FOR RESIDENTIAL,
COMMERCIAL AND INDUSTRIAL
APPLICATIONS

★ No motors, fans or bearings in exhaust line ★ Needs no stacks ★ Acid-resisting vitreous enamel finishes ★ Extremely high static pressures now available

FOR HEATING PLANTS AND INCINERATORS . . . *Quickdraft* provides constant draft for efficient and economical combustion. It eliminates pulsating or chattering, puffing, smoking and sooting. Costly, tall, unsightly stacks are unnecessary.

FOR INDUSTRY . . . *Quickdraft* now offers extremely high static pressures for EXHAUSTING corrosive gases, abrasives and paint sprays . . . for CONVEYING all types of bulk materials or wastes that can be moved by air.

FOR MOVING AIR in or out of buildings through ducts . . . *Quickdraft* is outstanding in performance and efficiency.

9010-QD

IMPORTANT NOTICE

To withstand corrosive gases, all *Quickdraft* units are available in standard acid-resisting vitreous enamel, No. 316 Stainless Steel, rigid plastics (P. V. C.) and with plastic and Fiberglass coatings.

Write today for Quickdraft Engineering Data.

Quickdraft
CORPORATION P. O. BOX 87-K • CANTON 1, OHIO

WE HEAR THAT . . .

▸ *TENNEY ENGINEERING, INC.* has organized an *AEROSPACE DIV.* for environmental test chamber research and development, and has dedicated a new refrigeration, heating, and air conditioning products plant in Wilmington, N.C.

▸ *LYNCH ASBESTOS CO.* has adopted the new name of *LASCO INDUSTRIES* to effect closer association of the company name with insulation, plastic pipe, and other products manufactured.

▸ *OCTAGON VENTILATOR CO.* will construct new plant facilities in Jackson, Tenn., for the production of commercial and industrial ventilators.

▸ *AMERICAN INSTRUMENT CO., INC.*, has organized a new subsidiary, *HYGRODYNAMICS, INC.*, with offices, engineering, and manufacturing facilities in Silver Spring, Md.

▸ *POLARAD ELECTRONICS CORP.* has acquired 100,000 sq ft of additional manufacturing facilities adjacent to its plants in Long Island City, N.Y.

▸ *MEL J. STEVENSON*, consulting mechanical engineer, is now engaged in private heating, piping and air conditioning consulting practice at 333 Kearny St., Rm 208, San Francisco 8, Calif.

▸ *CLEAVER-BROOKS CO.* has expanded its packaged boiler service parts operation and inaugurated a new central control facility for world-wide parts distribution at Lebanon, Pa.

▸ *INDUSTRIAL ACOUSTICS CO.* has announced that soundproof rooms and other noise control equipment which it constructs are now available on a lease basis, with optional purchase arrangements available at the end of lease periods.

▸ *HAVEG INDUSTRIES, INC.* has announced completion of new plastics research and development laboratory facilities in Taunton, Mass., designed for new materials development, precision molding research, development of special fabricating processes and to afford complete testing facilities.

▸ *DODGE MFG. CORP.* has announced the formation of a wholly owned subsidiary, *DODGE MFG. INTERNATIONAL A.G.*, with headquarters in Zug, Switzerland, to acquire and render technical and management assistance to the company's foreign licensees.

WE HEAR THAT

Continued

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.* has begun preliminary work on an addition to its metropolitan Minneapolis temperature controls plant in Golden Valley. The new addition will almost double the size of the present facility and will be staffed by an additional 1200 employees to be transferred from two of the firm's other Minneapolis plants.

▸ *THE TRANE CO.* has announced plans for the construction of a 120,000 sq ft addition to its manufacturing plant in Clarksville, Tenn. Scheduled completion date is February, 1961.

▸ *BROS INC.* has entered a license agreement with Dr. I. H. Vorkhauf and Associates, Berlin, Germany for exclusive rights for sale and manufacture of the German firm's patented high temperature hot water boiler.

▸ *THE PEERLESS HEATER CO.* recently was host to the Institute of Boiler and Radiator Manufacturers Cast Iron Manufacturing Group for a tour of the firm's foundry and discussions covering the establishment of better conditions throughout the industry.

▸ *FLOYD GAUNT* has retired as vice president and general manager of *REYNOLDS GAS REGULATOR CO.* after 40 years of service, but will remain as a consultant to the firm.

▸ *ARTHUR D. BENJAMIN* and *PETER FLACK* have announced the formation of their partnership as consulting engineers with offices at 37 W. 39th St., New York 18, N.Y.

▸ The name of *BROOKS ROTAMETER CO.* has been changed to *BROOKS INSTRUMENT CO., INC.* to reflect the firm's expanded activity in the field of flow measurement meters and related equipment manufacture.

▸ *YUBA CONSOLIDATED INDUSTRIES, INC.*, has purchased the *K. W. ANDERSON CO.*, Tulsa, Okla., manufacturer of high temperature furnaces for processing industries. The Anderson Co. will be consolidated with Yuba's Petro-Chem Development Div.

▸ *LEON E. JEANNERET*, manager of welded tubing sales for *BABCOCK & WILCOX CO.'s TUBULAR PRODUCTS DIV.*, has retired after 43 years service with the firm.

Here is the NEWEST and SMARTEST WAY to regulate AIR FLOW!

T.M.
DURO-TROL another FIRST from DURO-DYNE

For installation in exposed areas where smart, modern appearance and ease of adjustment are of prime importance, DURO-TROL is the answer! Made of high impact plastic, Duro-trol remains beautiful for years . . . no fading, rusting or peeling.
Exact position of damper is shown at a glance . . . eliminates guesswork. To readjust, simply push in, turn knob and release. Duro-trol clicks and locks into new position.

Ask your Duro-Dyne Distributor for a Demonstration

DURO DYNE CORP.
FARMINGDALE, NEW YORK

Mr. Contractor, it will pay you to consider this completely NEW concept in Damper Regulators for your next job!

DURO-DYNE'S
New! 3/8" WEDGE-LOC™ DAMPER REGULATOR SETS*

Rattle-Free!

*Pat. Pending

Eye-Appealing!

Super heavy construction of this new regulator and its wedge-loc action prevents damper rattle while it minimizes air leakage. New, eye-appealing design, easy-to-read and easy-to-adjust indicator dial.

Ask your Duro-Dyne Distributor for a Demonstration!

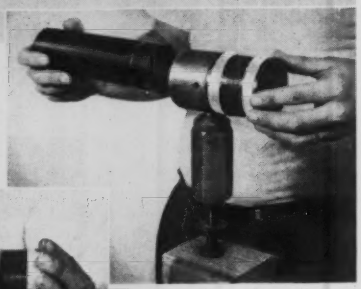
DURO DYNE CORP.
Farmingdale, New York

POLYFUSION*

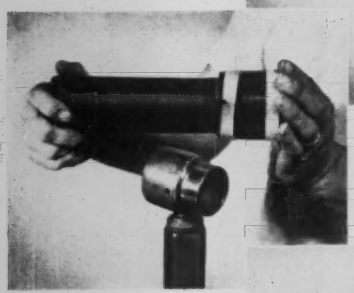
is one more reason

Vulcathene® DRAINLINES

are rugged and unbreakable!



Putting VULCATHENE Pipe and Fitting on Polyfusion Tool.



Joining VULCATHENE Pipe and Fitting by Polyfusion . . . without glue, cement or solvents.

DOUBLE-STRENGTH AT EVERY JOINT

Cutaway of VULCATHENE Pipe and Fitting showing complete fusion of material. *Note that it is impossible to see point of joining.*

If you are handling corrosive or acid materials, VULCATHENE, of *finest grade,* virgin polyethylene, will solve your drainline problems. VULCATHENE is light, easy-to-handle . . . assembles fast, with the polyfusion technique forming permanent, *leak-proof joints.*

Nothing adheres to VULCATHENE. Even after years of service, the inner walls of VULCATHENE are still smooth, assuring fast flow of waste and sludge.

Today, many leading industries are proving VULCATHENE the most practical and economical plumbing yet devised for laboratory and industrial drains.

For literature or technical assistance—Write Dept. 428

*PATENTED

American Vulcathene

P.O. BOX 365 ROCHESTER 2, NEW YORK

DIVISION OF THE NALGE CO. INC.

WHO'S WHAT . . .

(New personnel, promotions)

▸ *BOHN ALUMINUM AND BRASS CORP.* — Charles Simison and B. W. Reid, sales managers of unitary coils and heating and air conditioning departments, respectively.

▸ *A. M. BYERS CO.* — Victor C. Lawrence, general manager of sales; Richard I. Enzian and Ralph E. Whittaker, product managers for wrought iron and steel, respectively.

▸ *AIR-CONDITIONING AND REFRIGERATION INSTITUTE* — newly appointed training committee for service and installation personnel: Arthur E. Meling, Carrier Corp., chairman; Frederick J. Reed and George Mills, chief engineer and director of public relations for ARI, respectively, and Harry Gurney, Janitrol Heating and Air-Conditioning Division of Midland Ross Corp., members.

▸ *CARRIER CORP.* — newly elected corporation executive vice presidents with their particular responsibilities: Russell Gray, president of new Carrier Air Conditioning Co. division; Charles V. Fenn, assistant to the president; Melvin C. Holm, chairman of the planning committee and assistant to the chairman of the board; Walter Steitler, in charge of Elliott Co. and Carrier Research and Development Co. Other new assignments: Leon Hutton, corporate vice president, is designated executive vice president of Carrier Air Conditioning Co.; Thomas J. O. O'Neill, corporation comptroller; Vere L. Hunt, corporation treasurer. Messrs. Fenn and Holm will serve as directors of the corporation under a program of rotation of officers as board members for two year terms.

▸ *JOHNS-MANVILLE CORP.* — Don L. Hinmon, senior operating vice president to administer the Fiber Glass, Industrial Insulations, and Dutch Brand divisions; T. H. Eaton, John Jobe, and E. H. Wells have been appointed general managers of these divisions in the order named.

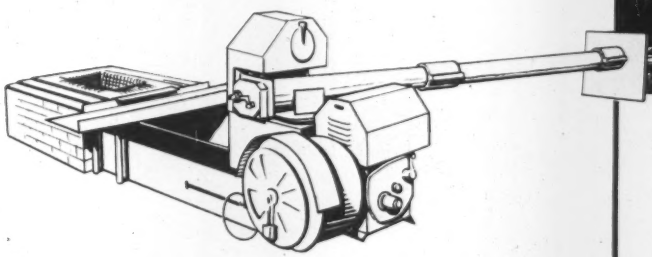
▸ *HOOKER CHEMICAL CORP.* — Horace W. Hooker, manager of licensing.

▸ *HITEMP WIRES, INC.* — Francis X. Buschman, director of research, development, and engineering.

▸ *FAIRBANKS, MORSE & CO.* — Stanley E. Wolkenheim, vice president, marketing.

MILWAUKEE ELKS CHOSE A MODERN STOKER*

* The modern Combustioneer CB Model Commercial Stoker, with a universal bin feed loader that conveys coal from nearly any angle and the unique sequence draft control to provide correct over-fire draft constantly and automatically.



- Rugged steel construction for long-life service
- Heavy duty transmission with no chains, no sprockets, no bearings to lubricate
- Patented automatic air respirator for correct fuel and air balance
- Burns coal, for greatest heating economy of any fuel

BITUMINOUS COAL EQUIPMENT, INC.
CARPENTERSVILLE, ILLINOIS

BE ON HAND

when buying decisions are made . . .

sources of supply investigated

START YOUR PLANNING NOW FOR ADEQUATE SPACE IN

HEATING, PIPING & AIR CONDITIONING'S

BIG JANUARY 1961 ISSUE WHICH WILL CONTAIN OUR DIRECTORY SECTION

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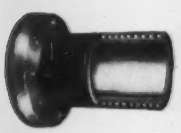
a quiet answer to noisy piping...

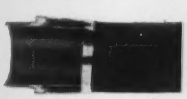


Style RFE— Integral molded rubber flanges keep entire hose length flexible . . . eliminate gaskets. Steel backup rings distribute bolt pressure.

VM QUIET-FLEX

REINFORCED FLEXIBLE RUBBER PIPE SECTIONS

Completely isolate pipe lines from pumps, centrifugal compressors, condensing units, water chillers and cooling towers. Quiet-Flex rubber pipe connections will withstand working pressures up to 250 psi . . . continuous operating temperatures up to 250°F.



Style MM— Brass fitted couplings with male pipe threads provide leak-proof connection with uniform full flow area. Stock sizes—¾" through 4" diameter in lengths 12" through 36".

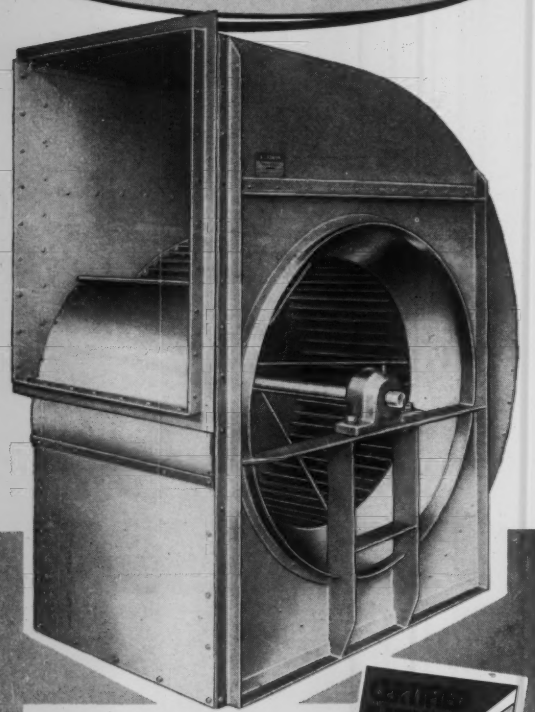
Write for descriptive Bulletin RFP-10 and Vibration Engineering Data Book.

If it's a noise or vibration problem, get the right answer — quick — from Representatives in Principal Cities of United States and Canada.

VIBRATION MOUNTINGS, INC.

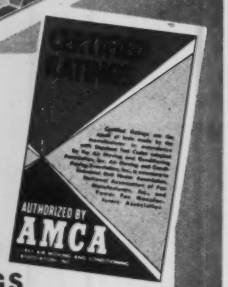
98-11 50th Avenue • Corona 68, New York

Aladdin
AIR HANDLING EQUIPMENT



FANS *with built-in quality*

- EFFICIENT
- QUIET OPERATING
- CERTIFIED RATINGS



ALADDIN Series 94 Type FC Fans are available in 22 sizes both single and double width. These fans have been designed for the lowest rotational speeds consistant with high efficiency over the widest possible range of operating conditions.

Each fan is ruggedly built... fully equal to the job for which it is designed, and is backed by thirty-five years of know-how in manufacturing all types of air handling equipment.

Write for complete data

ALADDIN HEATING CORPORATION
1111 WEST AVENUE 137 • SAN LEANDRO, CALIFORNIA

WHO'S WHAT

Continued

▸ *ARMCO STEEL CORP.* — Robert L. Myers, supervising research metallurgist; George H. Todd, assistant manager, George H. Yost, general supervisor, respectively, of the corporation's Ashland, Ky., works.

▸ *MINNEAPOLIS-HONEYWELL REGULATOR CO.* — Charles S. Marshall, manufacturing superintendent, Rubicon Division; William B. Shellenberger, manager of newly created planning and procurement department, Brown Instuments Division.

▸ *NATIONAL VALVE AND MFG. CO.* — William Goldsmith, production manager; William J. Dames, superintendent, Thirty-First St. plant; Ernest W. Scheidl, superintendent, Etna, Pa., plant.

▸ *ANSUL CHEMICAL CO.* — Jay H. Jarrett, sales manager, refrigeration products division.

▸ *IRON FIREMAN MFG. CO.* — Hugh Russell, assistant treasurer; John H. R. Hobbs, general manager of wholly owned subsidiary Iron Fireman Mfg. Co. of Canada, Ltd.

▸ *COMBUSTION ENGINEERING, INC.* — Lambert J. Gross, vice president and treasurer.

▸ *HYDROTHERM, INC.* — Kenneth F. Angelo, assistant national sales manager.

▸ *CRS INDUSTRIES, INC.* — George Maleno, Jr., project engineer for "Statronic Systems" installation.

▸ *HAVEG INDUSTRIES, INC.* — Thomas F. Anderson, vice president.

▸ *HEIL PROCESS EQUIPMENT CORP.* — Robert I. Peters, manager, "Rigidon" plant.

▸ *THE PHILIP CAREY MFG. CO.* — W. H. Owens, division staff engineer.

▸ *BRIDGEPORT BRASS CO.* — Newell W. Mitchell, consultant on corrosion problems for heat exchangers.

▸ *S. W. BROWN, Consulting Engineers* — Herbert Pomerantz, project manager, commercial and industrial designs.

WHO'S WHAT

Continued

▸ *WORTHINGTON CORP.* — C. Freeman, advertising and sales promotion manager; Henri Soumerai, chief engineer, compressor development; Raymond A. Mayer, manager of manufacturing for Air Conditioning and Refrigeration Division's East Orange, N.J., shell and tube works.

▸ *CLEAVER-BROOKS CO.* — H. F. Holtz, vice president and general manager, Packaged Boiler Firetube Division; new directors: James G. Brooks, corporation vice president, and J. E. Uihlein, Jr., of Milwaukee, Wis.

▸ *YORK DIV., BORG-WARNER CORP.* — Donald H. Swartz, manager of marketing development.

▸ *CRANE CO.* — Dale A. Lichty, vice president in charge of Systems & Controls Group.

▸ *THE BABCOCK & WILCOX CO.* — *M. E.* Ziegenhagen, director of advertising and public relations.

▸ *HAUCH MFG. CO.* — David M. Given, Jr., production engineer.

▸ *KOHLENBERGER ENGINEERING CO.* — Joseph T. Noland and Robert E. Britton, project engineers.

▸ *GENERAL ELECTRIC CO.* — J. Richard Garvin, manager of manufacturing, specialty motor department, succeeding Adolph J. Rose who will retire; William B. Boyd, manager of manufacturing specialty transformer department.

▸ *GENERAL RUBBER CORP.* — Arthur F. Becker and Robert L. Swenson, vice presidents in charge of manufacturing and engineering, respectively.

▸ *TACO HEATERS, INC.* — Peter L. Quattrochi, general sales manager.

▸ *INTERNATIONAL INSTITUTE OF WELDING* — newly elected international vice president: Fred L. Plummer, national secretary of the American Welding Society.

▸ *JOSEPH T. RYERSON & SON, INC.* — Richard E. Clark, manager of aluminum product sales, Detroit plant.

Great names—that made scientific filtration possible!

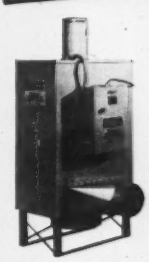
Bernoulli's Principle: "The pressure of a fluid, either liquid or gas, decreases as velocity increases and increases as velocity decreases."
Daniel Bernoulli (1700-1782)

For more than 35 years, Air-Maze has specialized in the filtration of liquids and gases. And although Bernoulli lived more than 200 years ago, our engineers must take into account his discoveries in designing and developing new products for industry.

From crawler tractors to jet aircraft . . . from gear cases to modern air-conditioned buildings, Air-Maze filters are keeping equipment running better and longer by keeping it clean and free from damaging contaminants.

Shown below are representative products developed by Air-Maze engineers to solve specialized filtration problems. If your product involves any gas or liquid that moves, Air-Maze can help you.

Only Air-Maze P-61 Permanent Dry Type panels combine extended area with water-washability. Result: lower resistance, greater dirt holding capacity.



Misti-Maze electronic oil mist and fume eliminator permits air recirculation, reducing heating or cooling load. Ideal for machining or welding operations. Includes motor and exhaust fan.

OTHER AIR-MAZE PRODUCTS:
Air Filters • Liquid Filters • Intake Silencers • Exhaust Spark Arresters
Breather Filters • Oil Mist Eliminators

AIR-MAZE
CLEVELAND 28, OHIO
A SUBSIDIARY OF ROCKWELL-STANDARD
ROCKWELL R STANDARD

WHO'S WHAT

Continued

▸ *THE TRANE CO.* — Donald F. Spirduso, advertising manager.

▸ *DUNHAM-BUSH, INC.* — Henry V. Pelton, vice president, operations.

▸ *GAS APPLIANCE ENGINEERS SOCIETY* — Mike Caparone, Grayson Controls Co., president of the national organization. New officers for West Coast chapter: Waldren Kennedy of Charles Koch Associates, president; Lambert Craemer of Robertshaw-Fulton Controls Co., vice president; Elwood Fairchild, consulting engineer, secretary, Leo Block of Wasteking-Universal Corp., treasurer; Ed Cowan of Solarflow Co., trustee.

▸ *AIRTHERM MFG. CO.* — Ben M. McDougall, sales manager, heating and air conditioning division.

▸ *FRICK CO.* — David J. Wood, manager of market planning.

▸ *HI-PRESS AIR CONDITIONING OF AMERICA, INC.* — Jerome Podell, chief engineer.

▸ *AMERICAN NUCLEAR SOCIETY* — named a Fellow at the recent annual meeting: Dr. Walter H. Zinn, vice president of nuclear activities, Combustion Engineering, Inc.

▸ *MODINE MFG. CO.* — W. R. McMahon, director of engineering and research.

▸ *THOMAS C. WILSON INC.* — Martha A. Wilson, chairman of the board; O J. Bagnoli, president; Alexander John, vice president.

▸ *AMERICAN STANDARD INDUSTRIAL DIVISION* — Kenneth W. Burkhardt, director of design standardization; William E. Wendover, product development engineer.

▸ *PALL CORP.* — Henry Petronis, vice president, manufacturing.

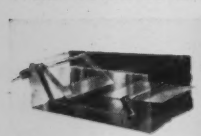
▸ *REMINGTON CORP.* — Herbert W. Field, vice president; Vincent Lopez, national service manager, air conditioning division.

▸ *BETHLEHEM STEEL CO.* — Charles W. Ganzel, manager of pipe and tube sales, succeeding Edwin A. Buxton, who will retire.

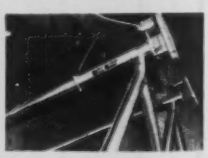
with Will-Burt's firing and control system!

A Will-Burt Firing and Control System will bring coal from bin to stoker . . . feed coal to the fire at any of three adjustable rates . . . automatically adjust air supply, minute by minute, according to fuel bed needs . . . and operate one, two, or more stokers on a pre-set cycle, according to hourly temperature requirements.

What could be more automatic . . . or more sensible?



W-B Automatic self-adjusting Air Control . . . part of every W-B Stoker.



W-B Coal Conveyor . . . power-reversing to clear obstructions . . . operates at any angle.

Take our word for it, it's economical. Write direct — or ask your Will-Burt Stoker Specialist for bulletins and help on selection and installation.

WILL-BURT STOKERS • Orrville, Ohio

MEETINGS & CONVENTIONS

SEPT. 7-9—*Joint Automatic Control Conference*, Massachusetts Institute of Technology, Cambridge, Mass.

SEPT. 14-17—*Second Annual Southeastern Maintenance and Engineering Show*. Sponsored by North Carolina chapters, American Institute of Plant Engineers, American Welding Society, and Maintenance Council of North Carolina Motor Carriers Assoc. State Fair Arena, Raleigh, N.C. Information: John Harden Associates, P.O. Box 3173, Greensboro, N.C.

SEPT. 26-29—*American Welding Society Fall Meeting*. Penn-Sheraton Hotel, Pittsburgh, Pa. Information: American Welding Society, 33 West 39th St., New York 18, N.Y.

SEPT. 26-30—*Instrument Society of America, Fall Instrument-Automation Conference and Exhibit, and* 15th *Annual Meeting*. New York Coliseum. Information: W. F. Minnick, Jr., Director of Public Relations, Instrument Society of America, 313 Sixth Ave., Pittsburgh 22, Pa.

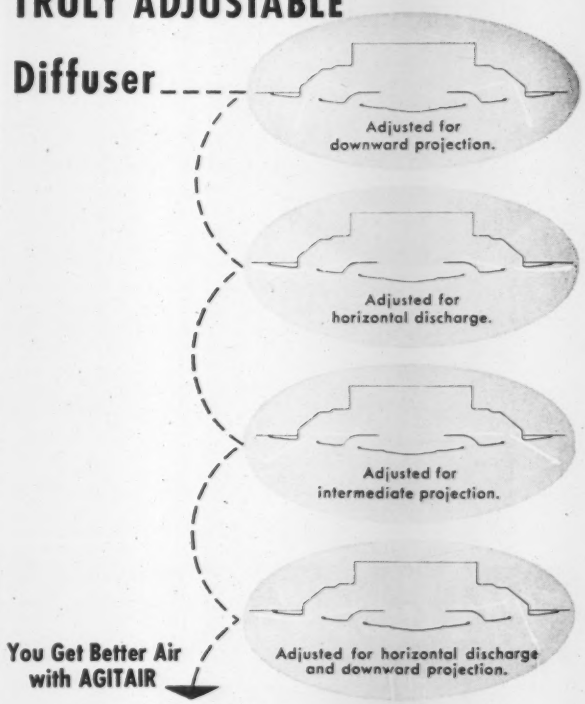
OCT. 12-15—*Cast Bronze Bearing Institute and Non-Ferrous Founders' Society annual meetings*. Grove Park Inn, Asheville, N.C. Information: Non-Ferrous Founders' Society, 1604 Chicago Ave., Evanston, Ill.

OCT. 17-21—*48th Annual National Safety Congress*. Industrial safety sessions, Conrad Hilton, Pick-Congress, Sheraton Towers, Morrison, and La Salle hotels, Chicago. Information: R. L. Forney, secretary, National Safety Council, 425 N. Michigan Ave., Chicago 11, Ill.

NOV. 28-*DEC.* 2—*24th National Exposition of Power and Mechanical Engineering*. Under auspices of the American Society of Mechanical Engineers. New York Coliseum. Information: International Exposition Co., Inc., 480 Lexington Ave., New York 17, N.Y.

DEC. 12-15 — *Industrial Building Exposition and Congress*. New York Coliseum. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

Take a look at a
TRULY ADJUSTABLE
Diffuser


Adjusted for downward projection.
Adjusted for horizontal discharge.
Adjusted for intermediate projection.
Adjusted for horizontal discharge and downward projection.
You Get Better Air with AGITAIR

AGITAIR®
TYPE "OA"

Here's a distinctively different diffuser with a radically new means of controlling air direction at four different angles of discharge simultaneously. *Without changing the position of the spinnings,* AGITAIR "OA" diffusers can be adjusted to put the air where you want it in one, two, three or four directions . . . *after installation.* Result: Segmentized . . . positive adjustability with Finger-Tip Air Direction Control.

Write for Bulletin C-101

Contains complete data, performance charts, construction details, etc.

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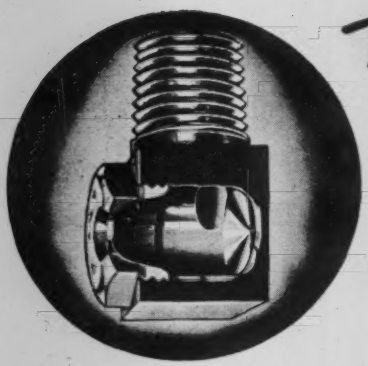

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NOZZLES
for
AIR WASHERS

These are "non-clogging" nozzles with a single large tangential lead hole to the swirl chamber that will never clog from any impurities small enough to pass through the orifice. Swirl chamber is conical on both ends and pivots liquid like a top to produce an exceptionally fine, evenly distributed, balanced spray of about 80° included angle. Wider spray angles up to 130° can be furnished to order.
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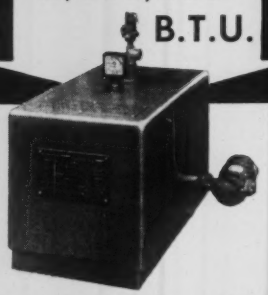
PHILADELPHIA 34, PA.
Canadian Agents: (Except B. C.)
E. S. Gallagher Sales Ltd., Toronto 12, Canada

ELECTRIC HOT WATER HEAT TO 2,000,000 B.T.U.



- 40,948 B.T.U. to 2,000,000 B.T.U. Output.
- All units meet the requirements of the ASME Boiler and Pressure Vessel Code.

PRECISION Electric HOT WATER HEATING BOILER

- **Complete unit ready for installation** with circulating hot water system and water chiller for year-round air-conditioning.
- **Conversion easily accomplished** where other type fuels now used. Suited for homes, churches, apartments, hotels, motels, hospitals, commercial buildings, swimming pools, snow melting and domestic hot water. Temperature Range 60 to 250 degrees.
- **Every unit tested and inspected.**

Write for color brochure and prices.

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400-HPAC North 1st. Street
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No ducts! No noise! No chimney! No odors! No flame!

MEETINGS & CONVENTIONS

Continued

1961

JAN. 23-26 — *National Plant Maintenance & Engineering Show.* International Amphitheater, Chicago. Information: Clapp & Poliak, Inc., Management, 341 Madison Ave., New York 17, N.Y.

FEB. 13-16 — *American Society of Heating, Refrigerating and Air-Conditioning Engineers, Inc., semi-annual meeting.* Conrad Hilton Hotel, Chicago, Ill. Information: ASHRAE, 234 Fifth Ave., New York 1, N.Y.

FEB. 13-16 — *International Heating and Air Conditioning Exposition.* International Amphitheater, Chicago, Ill. Information: E. K. Stevens, International Exposition Co., 480 Lexington Ave., New York 17, N.Y.

MARCH 27-31 — *Third National Symposium on Temperature — Its Measurement and Control in Science and Industry.* Sponsored by American Institute of Physics, Instrument Society of America, and National Bureau of Standards. Columbus, Ohio. Information: W. R. Tilley, National Bureau of Standards, Washington, D.C.

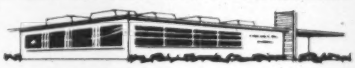
SEPT. 14-15 — *Fourth Annual Joint Military-Industrial Electronic Test Equipment Symposium.* Under joint sponsorship of the Office of the Director of Defense Research and Engineering, and the Department of the Army Signal Corp. Museum of Science and Industry, Chicago. Information: Robert Brausch, Conference Secretary, Armour Research Foundation, 10 W. 35th St., Chicago 16, Ill.

NEW BOOKS & REPORTS...

High Temperature Water for Heating and Light-Process Loads — Federal Construction Council Technical Report No. 37. 92 pp., with bibliography. Available from Printing and Publishing Office, National Academy of Sciences-National Research Council, 2101 Constitution Ave., Washington 25, D. C. $2.00.

DAVIDSON

LOW PROFILE



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PC PLEASING CONTOUR MODEL

New and streamlined . . . designed for today's modern flat roof structures . . . as much as 40% lower than conventional types . . . capacities up to 50,000 CFM . . . low velocity . . . vibration isolated . . . ratings conform to Standard Test Code.

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DAVIDSON FAN CO.

213 California St., Newton 58, Mass.

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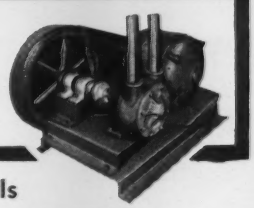

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- In packaged boiler or commercial heating applications
- Economically priced

Specifically developed for heavy fuel oils, in commercial heating applications and packaged boilers, the SU unit is compact . . . measures only 24¼" x 14⅝". Quiet operation insured by the 2 or 4 V-belt drive and integral gear positive displacement pump.

Quality construction features for dependability, low maintenance include two ball bearing pillow blocks, one point take up for simple adjustment of belt tension, removable belt guard, fabricated steel base motor mounting.

Furnished with wide variety of pumps and motors for pressures to 300 psi, capacities to 2030 gals. per hr. Sub-assemblies of pump, stub shafts, pillow block and sub-base also provided separately as a unit for incorporation into systems by boiler and furnace manufacturers.

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PARKER *Hot Water* BOILERS

for the finest in building heating

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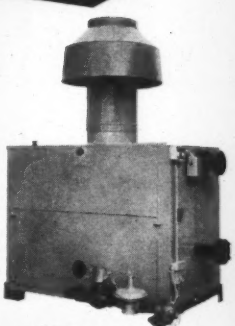

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MFG. CO.

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ADams 3-8263

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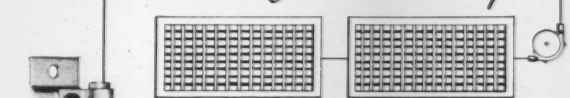

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Using Young Corner Pulleys this manually controlled regulator operates two Young No. 805 Dampers, size 18" x 12", over 250 feet away.

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Heating, Piping & Air Conditioning

January issue which contains our directory section

Start Making Your Plans Now For Adequate Space In The January 1961 Issue

NEW BOOKS & REPORTS

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Mercury Barometers and Manometers — by W. G. Brombacher, D. P. Johnson, and J. L. Cross. National Bureau of Standards Monograph 8, issued May 20, 1960. 59 pp. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. 40 cents.

Electro-acoustic and Electro-heating Definitions. — International Electrotechnical Commission (IEC) publications 50(08) and 50(40), respectively. American Standards Association, 10 E. 40th St., New York 16, N.Y. $4 and $3.20.

Commercial Kitchen Ventilation — Manual of requirements, design fundamentals, and effect of cooking appliances and exhaust systems on air conditioned areas. American Gas Association, Order Department, 420 Lexington Ave., New York 17, N.Y. 50 cents.

Mechanical Estimating — Combined Volumes I and II, 1960 Edition — by Hugh C. Carter. Covers piping, pumps, heating, air conditioning, and underground conduits. California Technical Publications, 2029 Atlantic Ave., Long Beach 6, Calif. $4.95.

ASTM Recommended Dimensional Standards for Prefabrication and Field Fabrication of Thermal Insulation Fitting Covers — 168 pp. Paper covered. American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 5.00.

Gas Shielded Arc Welding of Aluminum and Aluminum Alloy Pipe — 40 pp. Prepared by AWS Committee on piping and tubing. American Welding Society, Dept. T., 33 W. 39th St., New York 18, N.Y. $2.00.

NEMA Standards Publications — Adsorption Equipment (AD 1-1960) 40 cents. Industrial Heating Units and Devices (HU 1-1960) 30 cents. National Electrical Manufacturers Association, 155 E. 44th St., New York 17, N.Y.

A Bibliography on Propagation of Sound Through Plates—170 pp., by G. B. Thurston and R. Stern, University of Michigan. Office of Technical Services, U.S. Department of Commerce, Washington 25, D.C. (PB 161329) $3.00

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Rates for classified advertising are 20 cents for each word including heading and address. One inch $8.00. Count nine words for keyed address. Minimum $3.00 for each insertion. Cash must accompany order. Closing date 10th of month preceding issue.

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Manufacturer's agents to sell steam traps. Based on German invention, world-wide patents, newest and improved bimetallic type. Used in Europe with great success and astounding sales for three years. Being manufactured on this continent and specially redesigned for this country. Address Key 1481A, Heating, Piping & Air Conditioning, 6 N. Michigan Ave., Chicago 2, Ill.

Choice Territories open for Manufacturers Representative. Excellent opportunity to represent leading manufacturer of blower wheels, blower housings and fan blades for O.E.M. accounts. Desire replies from those now selling to manufacturers of air conditioning, heating and ventilating appliances and equipment. Reply to Sales Manager, Revcor, Inc., 259 E. Edwards Street, Carpentersville, Illinois.

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An established manufacturer with 25 years experience, producing ventilating equipment is looking for manufacturer's agents in many sections of the country to sell their new line of industrial fans.

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Manufacturers' Representative contacting engineers, mechanical contractors and distributors to represent established manufacturer of air filters. See our display ad elsewhere in this issue. Territories open: Ohio, Kentucky, Chicago, California and Mountain States. Microtron Corp., P. O. Box 2092, Charlotte 1, N. C.

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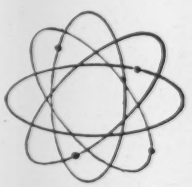
IDENTIFICATION NAME PLATES for controls and panels — precision engraved on bakelite or black anodized alum. — any titles — quick service by mail on small or large jobs — send for sample and prices. ATLANTIC ENGRAVERS, Coldbrook Road, Wilmington, Vermont.

VENTILATION ENGINEERS

Needed in the field of

ATOMIC ENERGY



Positions available in Plant Engineering division for graduate chemical or mechanical engineers with 3 to 5 years' experience in industrial ventilation systems. Background should include work on air purifiers, dust removal equipment. Must be capable of assuming supervisory responsibilities.

Our Company offers challenging technical work in a stimulating atmosphere, an excellent benefits program and company-paid re-location expenses. Salaries are commensurate with experience.

Please send resume of education, experience, and salary requirements, to Warren Wirtz, Employment Supervisor, Dept. J-105.

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Your best investment in modern air-handling equipment! New Aerovent Air Make-Up Units provide clean, fresh air in winter or summer; help maintain uniform temperature levels throughout working areas. Used as filtered-air supply units or air preheaters, these versatile units permit heating and ventilating systems to operate at design efficiency; equalize negative pressures by replacing exhaust air.

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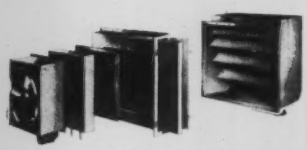

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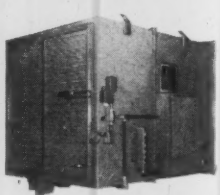

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Supplied in 4 unit arrangements for roof or wall mounting. Sizes 36" to 54" for various capacities, BTU ratings and pressure conditions.

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Air deliveries of all Aerovent equipment are tested and rated in accordance with established and accepted codes and each unit is guaranteed by the manufacturer to deliver its rated performance.

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Ash and Branch Streets — Piqua, Ohio

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Less time spent elbow-bending on the job

B.F.GOODRICH INSULATION TUBING CUTS IN HALF LABOR COSTS FOR INSULATING PIPE

IT'S as easy as slicing bread to cut elbows out of BFG insulation tubing—a sharp knife and a miter box are all you need. Parts cement together in seconds. Straight runs go on faster, too. If pipes are already connected, it can be slit, snapped on and cemented in half the time it usually takes for other methods of insulation. Slitting is unnecessary for new lines—it quickly slips on straight or bent pipe as easily as a ring on your finger.

B.F.Goodrich tubing is made of a tough, flexible rubber with millions of uniform, non-connecting cells that seal out air and moisture. It can be used for insulating pipes carrying hot or cold liquids at temperatures ranging from −20°F to 200°F. It's clean, easy to work with—doesn't rub off, chip or crumble. It comes in 6-foot lengths in many wall thicknesses that are easy to handle, easy to store. This BFG insulation is also self-extinguishing, so it can be installed on copper tubing before sweat fittings are made—tubing is merely pushed back and held by clamps while joint is soldered.

Try this labor-saving insulation on your next job. For full information on B.F.Goodrich insulation tubing, call your B.F.Goodrich distributor, or contact *The B.F.Goodrich Company, 181, Derby Place, Shelton, Connecticut.*

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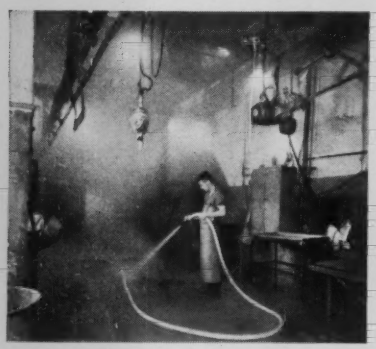
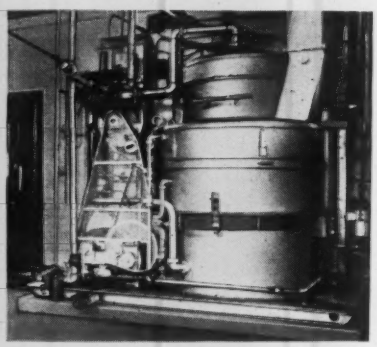
3 BOILERS IN 1 COMPACT PACKAGE!



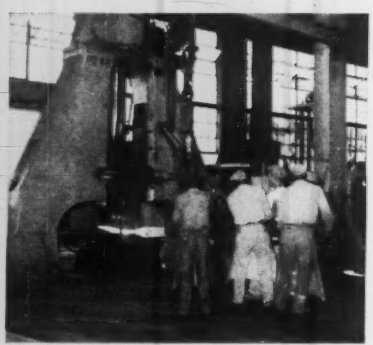
FOR ORDINARY STEAM REQUIREMENTS: The cycle-type Modulātic standard unit furnishes 90% dry steam for most ordinary needs such as cooking, heating water, drying, cleaning, etc.



WHERE DRY STEAM IS REQUIRED: The Modulātic may be used with an optional steam separator, for over 99% dry steam for heating, moulding, forges, operation of power equipment, etc.

VAPOR MODULĀTIC WATER TUBE BOILERS

¼ the size and weight of conventional boilers... largest size (150 BHP) uses only 5′ x 8′ space.



IF CONSTANT STEAM LOAD MUST BE MAINTAINED: For applications where even a nominal drop in pressure cannot be allowed, an optional steam reservoir may be added to the standard unit to provide a "cushion" during an off cycle.

Efficient . . . economical . . . proved in thousands of installations all over the world! Vapor Modulatics furnish high or low-pressure steam (at design pressures up to 1000 psi, or even higher). Lowest installation costs—delivered completely assembled, wired and tested . . . all sizes (40 to 150 BHP) fit through plant doors, with no special foundations or special chimneys needed. Simple push-button operation; built-in safety controls. May be mounted in multiple units to provide for the largest steam requirements—without the inefficiency of idling larger single boilers as demand slackens.

send for free literature:

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80 E. Jackson Blvd., Chicago 4, Ill.

Please rush me your free bulletins on Modulātic Water Tube Boilers.

NAME_____
TITLE_____
FIRM_____
ADDRESS_____
CITY, ZONE, STATE_____

Our requirements are:

BHP REQUIRED_____
SAFETY VALVE SETTING_____
MINIMUM STEAM LOAD_____
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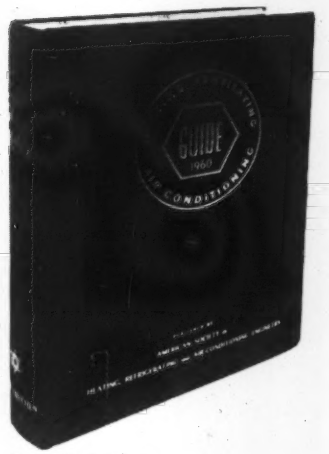

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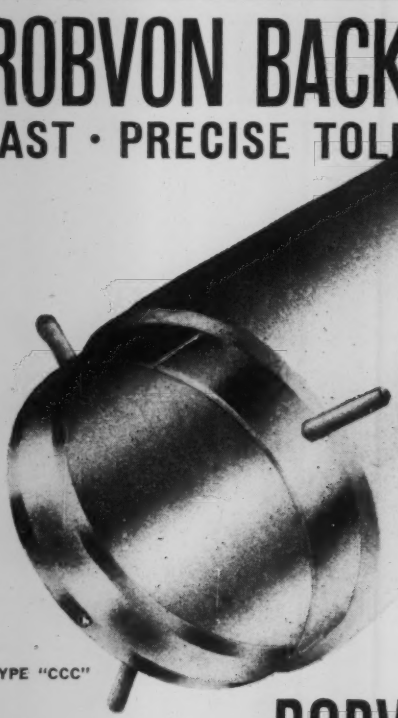

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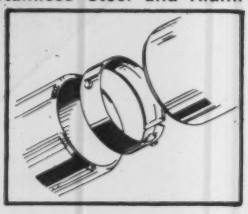

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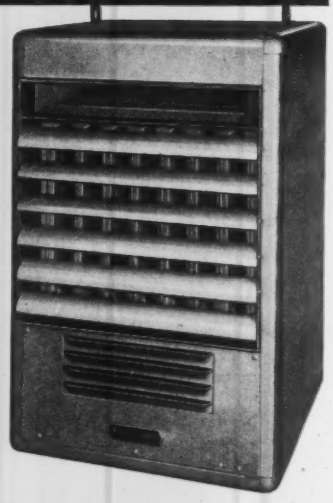

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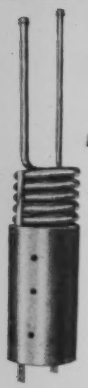

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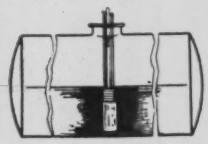

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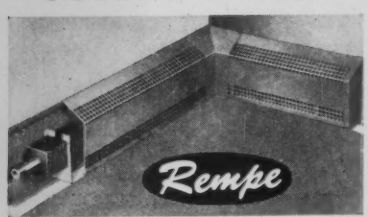

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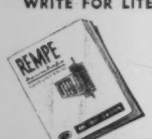

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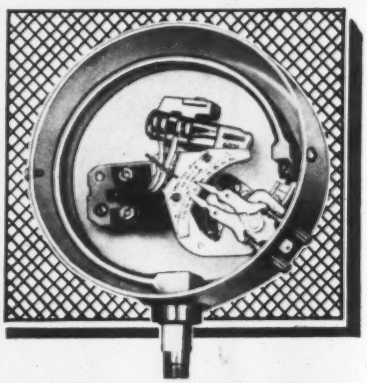

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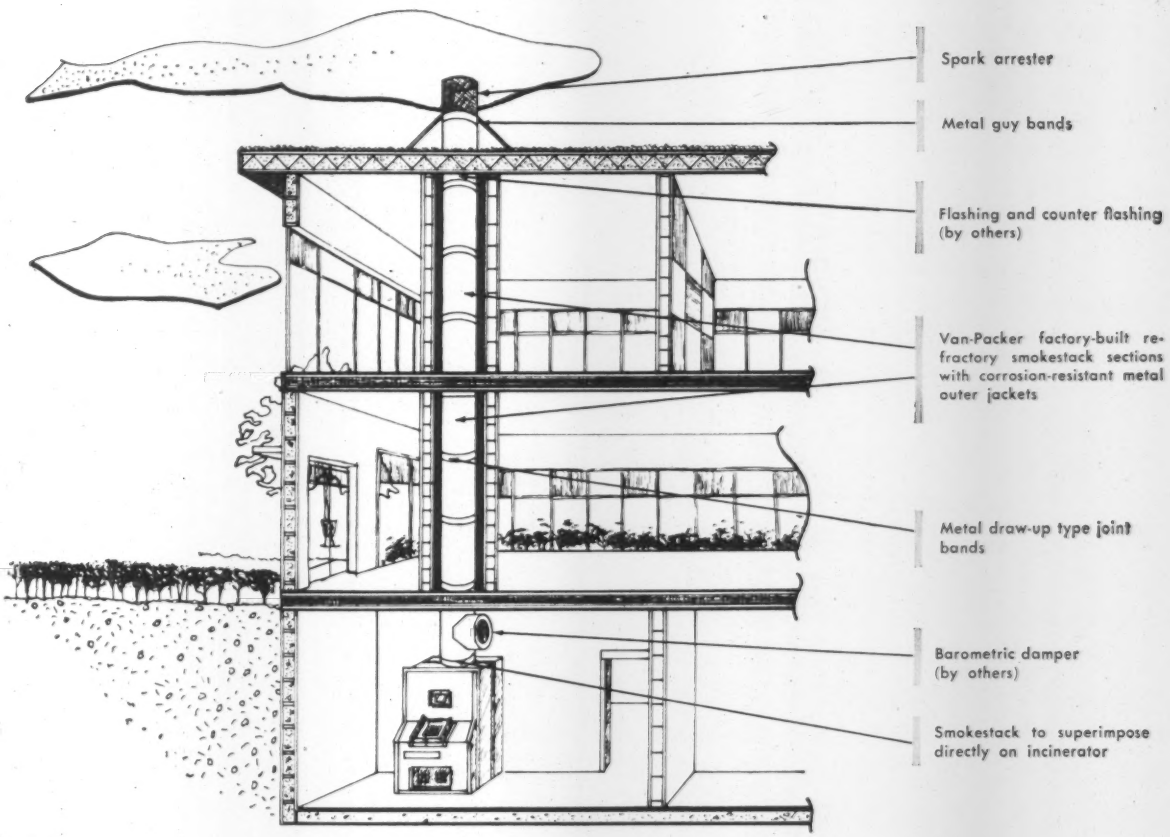
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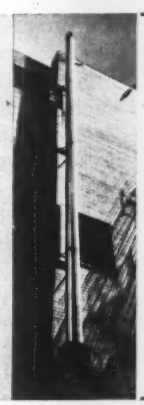

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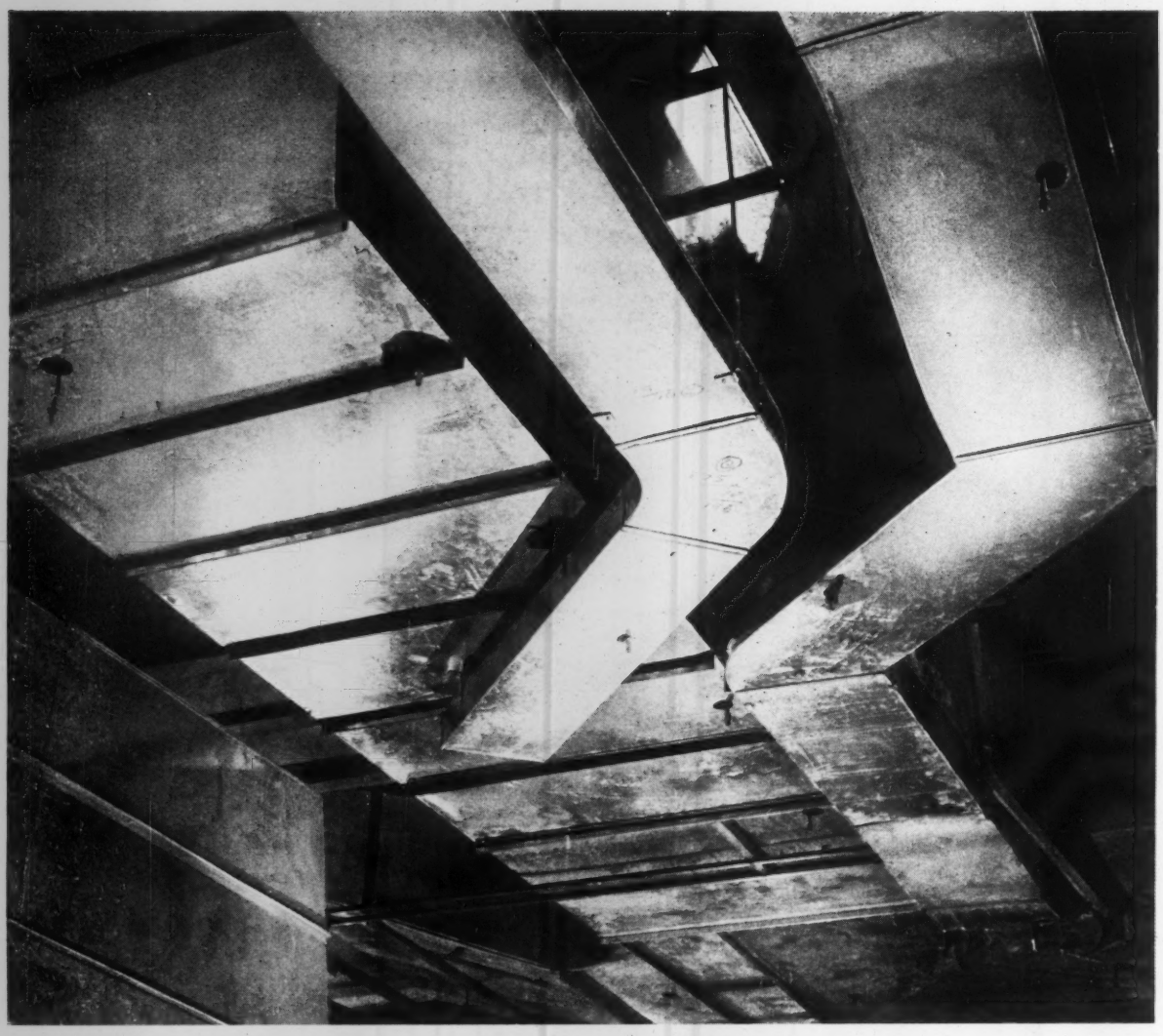

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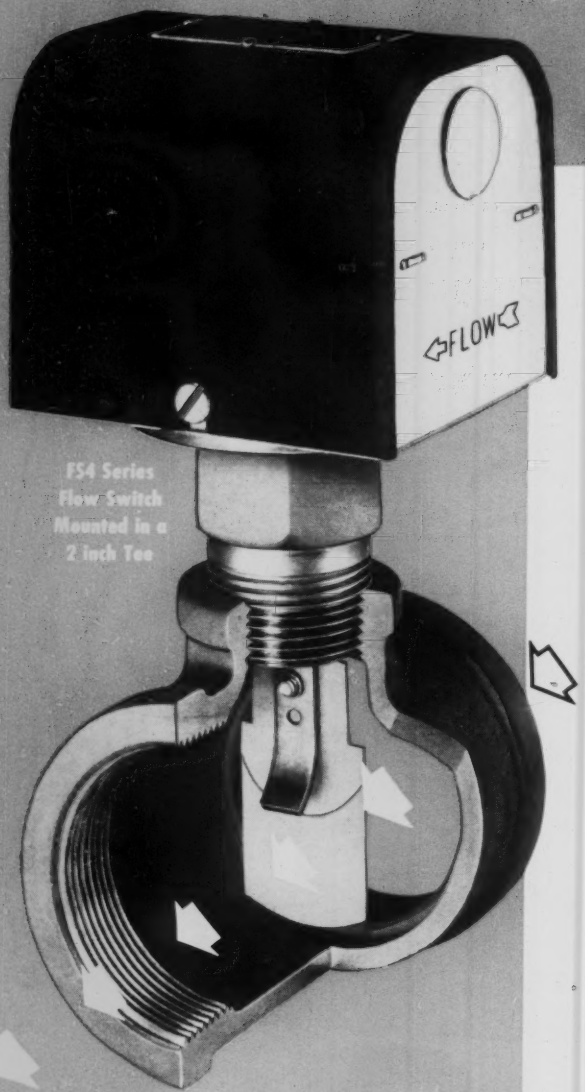
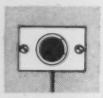


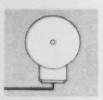
FS4 Series Flow Switch Mounted in a 2 inch Tee

Do you know how many jobs these switches can do?

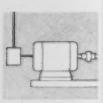
Look at the FS4 Series Flow Switch illustrated here. What you see is a compact, well-built switch that either makes or breaks a circuit (as required) when liquid flows or stops flowing. Yet in this versatile device you have both the most economical way and the most positive way of starting or stopping a signal, an alarm, a motor, a metering device — anything electrically operated. Just to highlight a few uses:—



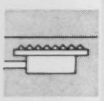
to actuate a signal light—signal an attendant to make the right moves in operating valves, pumps and the like—signal him when flow stops in a water cooled compressor, water cooled bearing and so on.



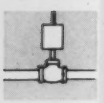
to sound an alarm—when flow stops in a process system or in any water cooled devices.



to start or stop motors—start pumps in sequence in multiple stage flow systems; start standby pumps; stop automatically controlled units if cooling water system fails; stop compressors in cooling systems when flow stops. These are *control* functions, and almost endless.



to start or stop automatic burners—start a booster heater when water draw occurs; stop burner if flow is improperly retarded; make sure of circulation in a boiler before burner is permitted to start.



to actuate metering device—open valve in chemical feeder line; start mixing in secondary line whenever flow starts in primary line.

Think it over! Some of these uses may suggest some related problem the FS4 can solve for you right now. Notice the facts about its construction and service range opposite.

McDonnell quality throughout:

Compact switch with positive snap action. Removable cover and two knockouts for easy wiring. Phosphor bronze sylphon seals assembly leak-tight from line. Paddle made in segments to fit any pipe from 1" through 3". FS4 series, illustrated, is for maximum working pressure 100 psi; maximum temperature, 300° F., in types as follows:

FS4-3 Single pole, double throw switch. Opens and closes two separate circuits with flow. Closes and opens same two circuits with no flow.

FS4 Closes with flow, opens with no flow.

FS4R Opens with flow, closes with no flow.

Underwriters' Listed

• Model E-2 available for larger pipe sizes and pressures to 150 psi.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Ave., Chicago 18, Ill.

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